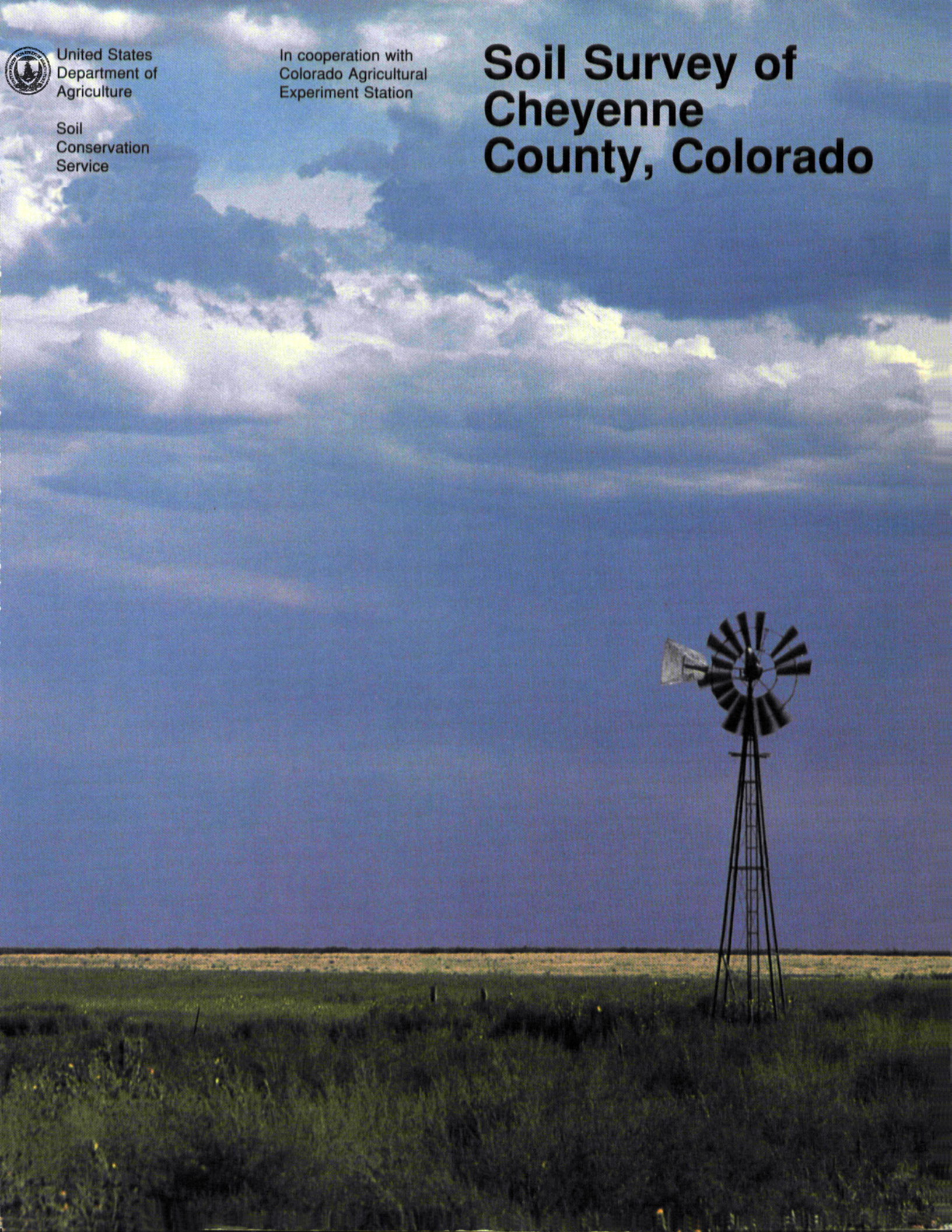
United States Department of Agriculture

Soil Conservation Service

In cooperation with Colorado Agricultural Experiment Station

Soil Survey of Cheyenne County, Colorado



How To Use This Soil Survey

General Soil Map

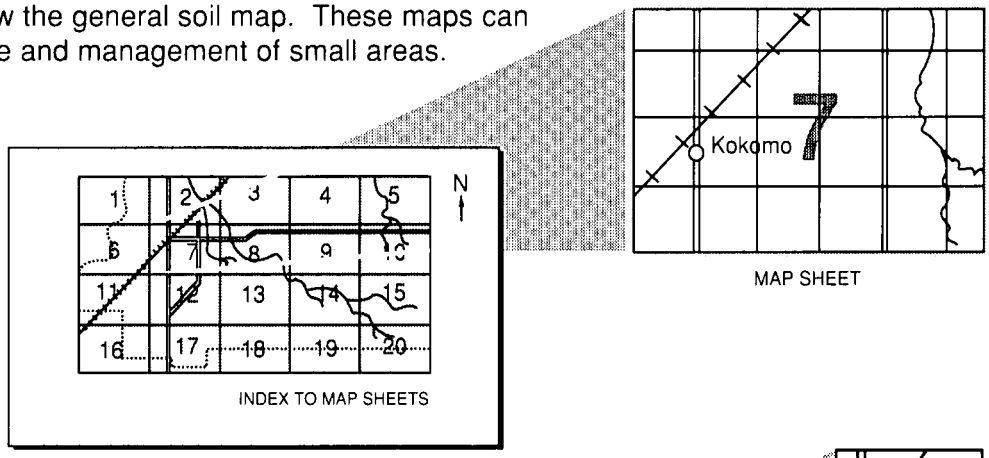
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

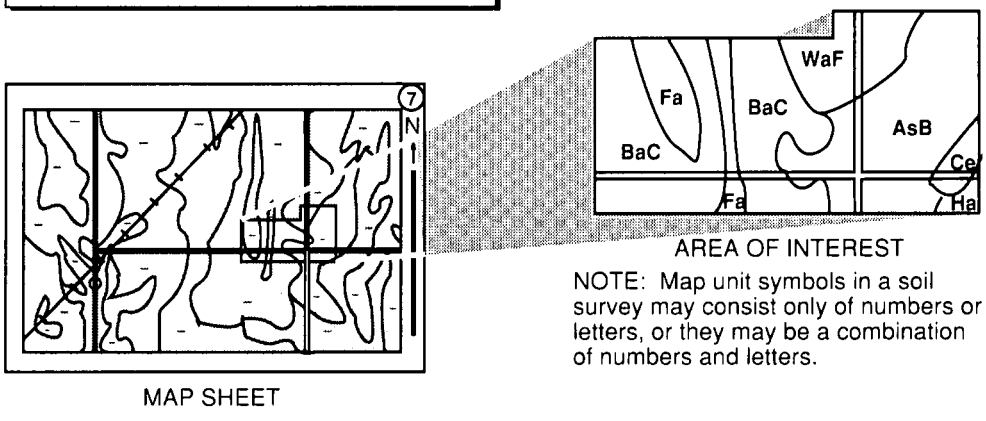
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Cheyenne Soil Conservation District. Funds were provided by the Cheyenne Soil Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Windmills are commonly used for pumping stock water in Cheyenne County.

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Issued September 1991

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Cheyenne County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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State Conservationist
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Soil Survey of Cheyenne County, Colorado

By Everett E. Geib, Soil Conservation Service

Fieldwork by Everett E. Geib, Stanley R. Albee, Donald W. Wickman, Barbara W. Cencich, and David L. Anderson, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the
Colorado Agricultural Experiment Station

CHEYENNE COUNTY is about 60 miles east to west and 30 miles north to south. It has an area of 1,141,037 acres. It is in the Great Plains. It is bordered on the west by Lincoln County, on the south by Kiowa County, on the north by Kit Carson County, and on the east by Kansas (fig. 1). The landscape generally is nearly level to rolling. Elevation is 5,000 feet in the northwestern part of the county. It gradually decreases to 3,900 feet in the southeastern part.

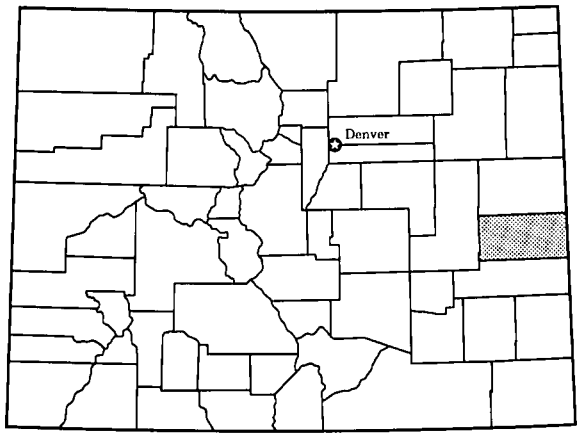

Figure 1.—Location of Cheyenne County in Colorado.

General Nature of the County

The paragraphs that follow give general information about Cheyenne County. They describe natural resources, agriculture, history, physiography and drainage, geology, and climate.

Natural Resources

Soil, water, oil, and natural gas are the major natural resources in Cheyenne County. Farming and ranching are the major enterprises. Oil and gas production is limited to relatively small fields, but it substantially benefits the overall local economy.

Agriculture

Approximately half of the survey area is cultivated, and half is native range. Cropland dominates the eastern half of the county. The clayey and sandy soils in the western part and the steeper soils along drainageways and on rolling hills are used primarily as native range.

Most of the cropland is nonirrigated. The dominant cropping system is one in which small grain is grown every other year and the cropland is left in summer fallow during the alternate years to increase the moisture supply and nutrient buildup in the soil. A small area of nearly level, sandy soils south of the town of Kit Carson is used for the annual production of grain sorghum. Irrigation water is drawn from wells in areas where water is available from the Ogallala Formation. Corn, sugar beets, dry beans, wheat, and alfalfa are grown in the irrigated areas.

Traditionally, the acreage of cropland and the acreage of rangeland have fluctuated with long-term climatic conditions. Recent improvements in farming methods and plant varieties and an increase in the extent of irrigation have increased crop production and the acreage of cropland.

History

When the Spanish explorers under Coronado ventured into the survey area in 1541, they found a great plain covered with grass that provided habitat for abundant bison, deer, and antelope *(5)*. The area was the hunting ground of several Indian tribes. The Arapahoe, Pawnee, Cheyenne, Kiowa, and Apache Indians are all thought to have hunted in this area.

Cheyenne County became part of the United States in 1803, the year of the Louisiana Purchase. The Smoky Hill Trail was a major route for fur traders, trappers, and explorers going to Bent's Fort along the Arkansas River and to the area where Denver is now located. With the end of the Civil War, the movement of cattle northward from Texas, and the discovery of gold in the Rocky Mountains, large herds of cattle and sheep were brought into the county to graze the plentiful grasses on government land.

The Homestead Act of 1862, the selling of railroad land in 1869, and the Desert Land Act of 1877 brought many farmers to the survey area *(5)*. Competition with the large ranches, the scarcity of water supplies, and the variable climate made the life of the early homesteader very difficult. The introduction of barbed wire in 1874 and the windmill improved the homesteader's lot and signaled the decline of the great cattle and sheep ranches *(6)*.

The First World War expanded the market for wheat and other grain. This expansion coincided with a period of good precipitation, accelerating the conversion of grassland to wheatland. The Depression, drought, and Dust Bowl of the early 1930's, however, ruined many farms.

After several years of reseeding with native grasses and the development of better farming methods, the fertile soils of Cheyenne County have again become stabilized and productive. Irrigation began in about 1951 *(4)*. Water stored in the Ogallala Formation was used for irrigation. About 50,000 acres is now used as irrigated cropland.

Physiography and Drainage

Cheyenne County is crossed diagonally from the northwest corner to the center of the south county line by a low ridge that separates the watershed of the Arkansas River from that of the Republican River. Precipitation falling north and east of this ridge averages 15 to 17 inches annually and drains northeast into the Republican River. Precipitation falling south and west of the ridge averages 13 to 15 inches annually and drains south to the Arkansas River.

The land surface north and east of the ridge is a gently sloping plain broken by rolling hills. Alluvial toe slopes grade to intermittent drainageways that dissect the plain. The soils in this area formed dominantly in Sanborn Loess on nearly level tablelands. The rolling hills and their toe slopes are underlain dominantly by mixed Sanborn Loess and material of the Ogallala Formation.

Southwest of the ridge, much of the Ogallala Formation has been eroded. The area along the ridge, however, has many small deposits of gravel from the Ogallala Formation. These deposits are mined for local use. The soils along the base of the ridge and in the adjacent basins along Spring and Wild Horse Creeks are strongly affected by the underlying Pierre Shale. The tablelands that are directly north of Big Sandy Creek and west of Kit Carson and extend to the Cheyenne-Lincoln county line generally are capped by a thin layer of Sanborn Loess. The soils in this area commonly formed in mixed parent material that has taken on the characteristics of the dominant local formation. The landscape south of Big Sandy Creek is mainly one of rolling sandhills and flat-bottomed valleys. In the extreme southwest corner of the county, however, a small area of nearly level loess extends northward from Kiowa County.

Geology

The Pierre, Ogallala, and Sanborn Formations influence the soils in the survey area. The three formations are of sedimentary origin and range in age from Late Cretaceous to Holocene *(3)*.

The Pierre Formation was deposited in a shallow salt sea during Late Cretaceous time. It underlies all of the county and is exposed in some areas in the western part of the county *(8)*. Soils in the Razor-Midway-Manzanola general soil map unit formed in material derived from Pierre Shale.

The Ogallala Formation consists of mixed material, chiefly sand and gravel deposited above the Pierre Formation during Pliocene time. Ogallala gravel beds are the main sources of ground water in the survey area. Soils in the Satanta-Kim general soil map unit formed mainly in material derived from the Ogallala Formation.

The eolian material of the Sanborn Formation was deposited over the Ogallala Formation during Pleistocene and Holocene times. The eolian material in the survey area occurs mainly as a relatively thin layer of loess that increases in thickness as it extends eastward into Kansas *(3)*. Soils in the Keith-Richfield-Ulysses general soil map unit formed in silty loess derived from the Sanborn Formation.

Small areas of Holocene alluvium border intermittent streams throughout the county. While important locally, they are of minor extent.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Cheyenne County is usually warm in summer. Temperatures are hot on many days. In winter very cold periods occur when arctic air moves in from the north or northeast. The cold periods alternate with milder periods, which often occur when westerly winds are warmed as they move downslope. Low annual precipitation is a limitation on nonirrigated cropland in most years. The precipitation falls mostly as rain during the warmer part of the year. It is heaviest in late spring and early summer. Snowfall is frequent in winter, but the snow cover usually disappears during mild periods.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Kit Carson in the period 1951 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 30 degrees F and the average daily minimum temperature is 14 degrees. The lowest temperature on record, which occurred at Kit Carson on January 4, 1959, is -24 degrees. In summer, the average temperature is 73 degrees and the average daily maximum temperature is 90 degrees. The highest recorded temperature, which occurred at Kit Carson on June 20, 1954, is 109 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 13 inches. Of this, 11 inches, or about 85 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 8 inches. The heaviest 1-day rainfall during the period of record was 5.45 inches at Kit Carson on August 19, 1965. Thunderstorms occur on about 60 days each year.

The average seasonal snowfall is about 24 inches. The greatest snow depth at any one time during the period of record was 17 inches. On the average, 6 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 65 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations,

supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

The words "limit of detailed soil survey" on the soil maps indicate areas where soil boundaries were interpreted, rather than mapped, because of owner preference. In these areas the soil boundaries were extended by a qualified soil scientist through the use of a stereoscope. This mapping is suitable for broad land use planning but is not to be substituted for a detailed soil survey.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general soil map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following section.

Soil Descriptions

Deep, Loamy Soils on Uplands

These soils make up about 60 percent of the survey area. The native vegetation is mainly short and mid grasses. Elevation is 3,900 to 5,250 feet. The average annual precipitation is about 13 to 17 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

These soils are deep and well drained. They are nearly level to strongly sloping. They formed in loess and mixed loamy material derived dominantly from sedimentary rock. They are used mainly for cultivated crops. They also are used as rangeland.

1. Keith-Richfield-Ulysses

Nearly level and gently sloping, deep, well drained, dark colored soils that formed in silty eolian material

This map unit is primarily in the eastern half of the survey area. It is mainly on nearly level to undulating uplands. The landscape is characterized by large nearly level areas, by gentle, uniform slopes, and by poorly defined drainageways. Slope is 0 to 5 percent. The vegetation is mainly short and mid grasses. Elevation is 3,900 to 4,300 feet. The average annual precipitation is about 15 to 17 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 24 percent of the survey area. It is about 48 percent Keith soils, 15 percent Richfield soils, 15 percent Ulysses soils, and 22 percent soils of minor extent.

Keith soils are on flats and side slopes. They formed in calcareous loess derived dominantly from sedimentary rock. The surface layer is silt loam. The subsoil is silty material. Below this to a depth of 60 inches or more is calcareous, silty loess.

Richfield soils are in level or concave areas and in poorly defined drainageways. They formed in calcareous loess and alluvium derived dominantly from sedimentary rock. The surface layer is silt loam. The subsoil is silty material. Below this to a depth of 60 inches or more is calcareous, silty loess.

Ulysses soils are on side slopes and hilltops. They formed in calcareous loess derived dominantly from sedimentary rock. The surface layer is silt loam. The subsoil is calcareous, silty material. Below this to a depth of 60 inches or more is calcareous, silty loess.

Of minor extent in this unit are Goshen, Satanta, Colby, Weld, and Wiley soils. Goshen and Satanta soils are in and near the better defined drainageways. Colby and Wiley soils are on slope breaks and in areas where the hazard of soil blowing is moderate. Weld soils are in nearly level or concave areas.

Most areas of this unit are used for cultivated crops. A few are used as rangeland. This unit is well suited to most uses. It has few limitations.

This unit has high potential as habitat for openland wildlife, such as pheasant, cottontail, mourning dove, and various songbirds. The potential is especially high in irrigated areas, where a great variety of crops and cover types can be grown. Measures that enhance openland wildlife populations include planting trees and

shrubs and providing undisturbed nesting cover. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife.

The habitat for rangeland wildlife, such as antelope, jackrabbits, lark bunting, and horned lark, can be improved in areas of grassland by properly managing livestock grazing, installing fences that permit the free movement of antelope, and developing livestock watering facilities.

2. Wiley-Colby

Gently sloping and strongly sloping, deep, well drained, calcareous, light colored soils that formed in silty eolian material

This map unit is in the west-central and south-central parts of the survey area. It is mainly on long, uniform slopes and on undulating to rolling uplands. The landscape is characterized by moderately wide, poorly defined drainageways in the gently sloping areas and well defined drainageways in the strongly sloping areas. Slope is 0 to 12 percent. The vegetation is mainly short and mid grasses. Elevation is 4,150 to 4,550 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 11 percent of the survey area. It is about 50 percent Wiley soils, 30 percent Colby soils, and 20 percent soils of minor extent.

Wiley soils are on long, uniform slopes and on side slopes. They formed in silty loess derived dominantly from sedimentary rock. The surface layer commonly has been lost through erosion. The soils are silty throughout.

Colby soils are on hills, ridges, and side slopes. They formed in silty loess derived dominantly from sedimentary rock. The surface layer commonly has been lost through erosion. The soils are calcareous and silty throughout.

Of minor extent in this unit are Kim, Stoneham, Baca, Keith, and Satanta soils. Kim and Stoneham soils are on slope breaks, hilltops, and the banks of drainageways. Baca soils are on flats. Keith and Satanta soils are in and near moderately well defined drainageways.

This unit is used mainly for nonirrigated crops. It also is used as rangeland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is moderately well suited to nonirrigated crops where slopes are less than 6 percent. The main management concern is the hazard of erosion.

This unit is moderately well suited to homesite development and sewage disposal systems. The main management concerns are a moderate shrink-swell potential, the hazard of erosion, and the slope.

3. Wiley-Baca

Nearly level and gently sloping, deep, well drained, light colored soils that formed in silty eolian material

This map unit is in the west-central part and southwest corner of the county. It is mainly on large upland flats and on gently sloping ridges and side slopes. The landscape is characterized by poorly defined drainageways and a few playas. Slope is 0 to 5 percent. The vegetation is mainly short and mid grasses. Elevation is 4,400 to 4,800 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 3 percent of the survey area. It is about 50 percent Wiley soils, 40 percent Baca soils, and 10 percent soils of minor extent.

Wiley soils are on nearly level and gently sloping ridges, hills, and side slopes. They formed in silty loess derived dominantly from sedimentary rock. The surface layer commonly has been lost through erosion. The soils are silty throughout.

Baca soils are in slightly concave or nearly level areas on upland plains and in swales. They formed in silty loess derived dominantly from sedimentary rock. They are silty throughout. The surface layer is medium textured. The subsoil is fine textured. Below this to a depth of 60 inches or more is medium textured material.

Of minor extent in this unit are Colby, Stoneham, and Weld soils. Colby soils are on slope breaks. Stoneham soils are on side slopes and in gently sloping areas on ridges, where sand has been mixed with silty loess. Weld soils are along poorly defined drainageways.

This unit is used mainly for nonirrigated crops. It also is used as rangeland.

Wildlife habitat is an important use of this unit. The

unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is moderately well suited to nonirrigated crops. The main management concern is the hazard of erosion.

This unit is moderately well suited to homesite development and sewage disposal systems. The main limitations are a high shrink-swell potential and moderately slow permeability in the Baca soils.

4. Satanta-Kim

Nearly level to strongly sloping, deep, well drained, dark and light colored soils that formed in mixed loamy material

This map unit is in the eastern half of the survey area. It is mainly on valley side slopes and rolling hills. The landscape is characterized by complex slopes and well defined drainageways. Slope is 0 to 20 percent. The vegetation is mainly short and mid grasses. Elevation is 4,000 to 4,500 feet. The average annual precipitation is about 15 to 17 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 10 percent of the survey area. It is about 40 percent Satanta soils, 25 percent Kim soils, and 35 percent soils of minor extent.

Satanta soils are on gently sloping and sloping side slopes. They formed in mixed loamy material derived dominantly from sedimentary rock. They are loamy throughout.

Kim soils are on gently sloping to strongly sloping hills and ridges. They formed in mixed loamy material derived dominantly from sedimentary rock. The surface layer commonly has been lost through erosion. The soils are loamy and calcareous throughout.

Of minor extent in this unit are Ascalon, Manter, Stoneham, Eckley, Colby, Canyon, Sampson, Glenberg, and Bankard soils. Ascalon, Manter, Stoneham, Eckley, Colby, and Canyon soils are on slope breaks and side slopes. Sampson, Glenberg, and Bankard soils are on narrow terraces near well defined drainageways.

This unit is used mainly as rangeland. It also is used for cultivated crops.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is poorly suited to cultivated crops in areas where slopes are more than 6 percent. The main management concerns in these areas are the hazard of erosion, droughtiness, and the slope. The slope is the main limitation affecting homesite development.

5. Stoneham-Fort Collins

Nearly level to sloping, deep, well drained, light colored soils that formed in mixed loamy material

This map unit is primarily in the central and northwestern parts of the survey area. It is mainly in transitional areas between loess uplands and other landforms. The landscape is characterized by nearly level to gently sloping areas cut by a few moderately well defined drainageways that have narrow, sloping banks. Slope is 0 to 12 percent. The vegetation is mainly short and mid grasses. Elevation is 4,200 to 5,250 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 12 percent of the survey area. It is about 40 percent Stoneham soils, 30 percent Fort Collins soils, and 30 percent soils of minor extent.

Stoneham soils are on ridges, hills, and valley side slopes. They formed in mixed medium textured material derived dominantly from sedimentary rock. They are medium textured throughout.

Fort Collins soils are on nearly level and gently sloping flats and side slopes. They formed in mixed medium textured material derived dominantly from sedimentary rock. They are medium textured throughout.

Of minor extent in this unit are Olney, Vona, Kim, Wiley, Schamber, and Manzanola soils. Olney, Vona, Kim, and Wiley soils are on gently sloping and sloping

hills and ridges. Schamber soils are on gravel edges and points on old high terraces. Manzanola soils are on low flats, generally near drainageways.

This unit is used mainly as nonirrigated cropland. It also is used as rangeland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is moderately well suited to nonirrigated crops. The main management concerns are the hazard of erosion and a restricted moisture supply.

This unit is well suited to homesite development and sewage disposal systems.

Soils That Formed in Dominantly Sandy Material

These soils make up about 30 percent of the survey area. The native vegetation is mainly grass and sagebrush. Elevation is 4,000 to 5,200 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

These soils are deep and are well drained to excessively drained. They are nearly level to moderately steep. They formed in mixed sandy alluvium and loess derived dominantly from sedimentary rock. They are used mainly as rangeland. A few areas are used as nonirrigated cropland.

6. Valent-Bijou-Vona

Undulating and rolling, deep, somewhat excessively drained and excessively drained soils that formed in sandy eolian and alluvial material or in mixed sandy and loamy eolian and alluvial material

This map unit is in the southwestern part of the survey area. The landscape is characterized by undulating and rolling sandhills and by few, if any, drainageways, which are poorly defined. Slope is 0 to 12 percent. The vegetation is mainly grass and sagebrush. Elevation is 4,000 to 4,800 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 18 percent of the survey area. It is about 35 percent Valent soils, 25 percent Bijou soils, 25 percent Vona soils, and 15 percent soils of minor extent.

Valent soils are in areas of dunelike relief. They are excessively drained. They formed in sandy eolian material derived dominantly from sedimentary rock. The surface layer is loamy sand. Below this to a depth of 60 inches or more is sandy material.

Bijou soils are on side slopes and upland flats. They are somewhat excessively drained. They formed in sandy and loamy eolian and alluvial material derived dominantly from sedimentary rock. The surface layer is loamy sand. The subsoil is sandy loam. Below this to a depth of 60 inches or more is sandy material.

Vona soils are on ridges and hills. They are somewhat excessively drained. They formed in moderately coarse textured, calcareous eolian material derived dominantly from sedimentary rock. The surface layer is loamy sand. The subsoil is sandy loam. Below this to a depth of 60 inches or more is calcareous, mixed sandy and loamy material.

Of minor extent in this unit are Olney soils, Ulm loamy sand, Sundance soils, and Manzanola soils on side slopes and valley bottoms. Ulm loamy sand and Manzanola soils are in areas where moisture accumulates.

Most areas of this unit are used as rangeland. A few areas that are dominantly minor soils are used as cropland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is poorly suited to cropland. The main management concerns are the hazard of soil blowing, droughtiness, and low fertility.

This unit is moderately well suited to homesite development. The main management concerns are the hazard of soil blowing and the instability of cutbanks.

7. Sundance-Olney

Nearly level, deep, well drained soils that formed in

sandy material over loamy material or in mixed sandy material

This map unit is in the southwestern part of the survey area. It is mainly on toe slopes and wide valley bottoms in the sandhills. The landscape is characterized by few, if any, drainageways, which are poorly defined, and by a few scattered playas. Slope is 0 to 3 percent. The vegetation is mainly grass. Elevation is 4,250 to 4,400 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 1 percent of the survey area. It is about 50 percent Sundance soils, 35 percent Olney soils, and 15 percent soils of minor extent.

Sundance soils are on flats. They formed in sandy material over loamy material derived dominantly from sedimentary rock. The surface layer is sandy. The subsoil is medium textured to moderately fine textured. Below this to a depth of 60 inches or more is calcareous, loamy material.

Olney soils are on side slopes and in slightly convex areas. They formed in mixed sandy material and loess derived dominantly from sedimentary rock. The surface layer is sandy loam. The subsoil is sandy clay loam. Below this to a depth of 60 inches or more is calcareous, medium textured to coarse textured material, which gradually becomes coarser textured with increasing depth.

Of minor extent in this unit are Vona and Bijou soils and Ulm loamy sand. Vona and Bijou soils are on gently sloping hills, ridges, and side slopes. Ulm loamy sand is on and near playas.

Most areas of this unit are used for nonirrigated crops, mainly grain sorghum. Among the other crops grown are forage sorghum and wheat. Some areas are used as rangeland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is moderately well suited to cropland. The main management concerns are droughtiness, the hazard of soil blowing, and low fertility.

This unit is well suited to homesite development. The main management concerns are the hazard of soil blowing and droughtiness.

8. Manzanola-Olney

Nearly level and gently sloping, deep, well drained soils that formed in fine textured alluvium or in mixed sandy material

This map unit is in the western part of the survey area. It is mainly in undulating areas consisting of clayey soils on valley bottoms and gently sloping, moderately sandy soils on ridges and hills. The landscape is characterized by moderately well defined drainageways and a few shallow depressions. Slope is 0 to 6 percent. The vegetation is mainly grass, but some scattered sagebrush is on hills and ridges. Elevation is 4,200 to 4,550 feet. The average annual precipitation is about 13 to 15 inches, the average air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 6 percent of the survey area. It is about 40 percent Manzanola soils, 35 percent Olney soils, and 25 percent soils of minor extent.

Manzanola soils are on nearly level fans, terraces, and valley side slopes. They formed in fine textured alluvium derived dominantly from soft, calcareous shale. The surface layer is moderately fine textured. The subsoil is fine textured. Below this to a depth of 60 inches or more is moderately fine textured or medium textured material. These soils are slightly affected by salts and alkali.

Olney soils are on gently sloping hills, ridges, and fans. They formed in mixed sandy material and loess derived dominantly from sedimentary rock. The surface layer is sandy loam. The subsoil is sandy clay loam. Below this to a depth of 60 inches or more is calcareous, medium textured material, which gradually becomes coarser textured with increasing depth.

Of minor extent in this unit are Stoneham, Vona, Fort Collins, Razor, Heldt, Ulm, and Arvada soils. Stoneham soils are on ridges, hilltops, and side slopes. Vona soils are on slope breaks and sandy hills and ridges. Razor soils are on side slopes. Fort Collins soils are on toe slopes and terraces. Heldt and Ulm soils are on valley bottoms near drainageways. Arvada soils are in shallow depressions and seep areas.

This unit is used mainly as rangeland. It also is used as nonirrigated cropland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife

habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is moderately well suited to nonirrigated crops. The main management concerns are low fertility and the hazard of soil blowing.

This unit is moderately well suited to homesite development. The main management concern is the hazard of soil blowing. Careful site selection and onsite investigation are needed.

9. Vona-Yoder-Schamber

Sloping and moderately steep, deep, somewhat excessively drained and excessively drained soils that formed in mixed sandy material or in mixed calcareous material

This map unit is in the northwestern part of the survey area. It is mainly on hills and in strongly sloping areas. It also is in nearly level and sloping areas underlain by mixed sand and gravel. The landscape is characterized by hilly topography deeply dissected by drainageways. Slope is 0 to 35 percent. The vegetation is mainly grass and scattered areas of sagebrush. Elevation is 4,500 to 5,200 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 5 percent of the survey area. It is about 35 percent Vona soils, 20 percent Yoder soils, 20 percent Schamber soils, and 25 percent soils of minor extent.

Vona soils are on hills and ridges. They are somewhat excessively drained. They formed in moderately coarse textured, calcareous eolian material derived dominantly from sedimentary rock. The surface layer is loamy sand. The subsoil is sandy loam. Below this to a depth of 60 inches or more is calcareous, mixed sandy and loamy material.

Yoder soils are on nearly level and gently sloping upland flats and side slopes. They are somewhat excessively drained. They formed in mixed loamy material over sand and gravel derived dominantly from mixed sources. The soils are sandy loam in the upper part, are sandy clay loam in the next part, and are underlain by sand and gravel at a depth of 12 to 20 inches.

Schamber soils are on knobs, hilltops, and slope breaks. They are excessively drained. They formed in sand and gravel derived dominantly from the Ogallala Formation. The surface layer is gravelly sandy loam. Below this to a depth of 60 inches or more is mixed sand and gravel.

Of minor extent in this unit are Stoneham, Midway, Razor, Olney, Glenberg, and Bankard soils. Stoneham, Midway, Razor, and Olney soils are on side slopes. Glenberg and Bankard soils are on narrow terraces next to drainageways.

Most areas of this unit are used as rangeland. A few are used as nonirrigated cropland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is poorly suited to nonirrigated crops. The main management concerns are droughtiness, the hazard of soil blowing, the slope, and low fertility.

The main management concerns affecting homesite development are the slope and the hazard of soil blowing. Careful site selection and onsite investigation are needed.

Nearly Level to Sloping Soils That Formed in Shale Residuum or in Mixed Loamy Material

These soils make up about 7 percent of the survey area. The native vegetation is mainly grass. Elevation is 4,100 to 5,200 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

These soils are shallow to deep and are well drained. They formed in loess, colluvium, residuum, and alluvium derived dominantly from sedimentary rock. They are used mainly as rangeland. A few areas are used as nonirrigated cropland.

10. Razor-Midway-Manzanola

Nearly level to sloping, shallow to deep, well drained

soils that formed in fine textured shale residuum or in moderately fine textured alluvium

This map unit is in the western part of the survey area, north of Big Sandy Creek. It is mainly on side slopes between upland flats and deeply dissected drainageways. The landscape is characterized by long, uniform slopes and deeply dissected drainageways. Slope is 0 to 15 percent. The vegetation is mainly grass. Elevation is 4,550 to 5,200 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 1 percent of the survey area. It is about 40 percent Razor soils, 25 percent Midway soils, 15 percent Manzanola soils, and 20 percent soils of minor extent.

Razor soils are on side slopes. They are moderately deep. They formed in residuum derived dominantly from clay shale. They are clay throughout. Weathered shale is at a depth of 20 to 40 inches. These soils are slightly affected by salts and alkali.

Midway soils are on ridgetops, slope breaks, and the upper side slopes. They are shallow. They formed in residuum derived dominantly from shale. About 50 percent of the surface is covered with gravel containing ironstone and gypsum. The soils are clayey and are underlain by shale at a depth of 10 to 20 inches. They are moderately affected by salts and alkali.

Manzanola soils are on side slopes, fans, and terraces. They are deep. They formed in alluvium and colluvium derived dominantly from calcareous shale. The surface layer is moderately fine textured. The subsoil is fine textured. Below this to a depth of 60 inches or more is moderately fine textured or medium textured material. These soils are slightly affected by salts and alkali.

Of minor extent in this unit are shale outcrop and Stoneham, Olney, Fort Collins, Kim, and Heldt soils. The shale outcrop and Kim and Stoneham soils are on slope breaks and in strongly sloping areas. Olney and Fort Collins soils are on side slopes. Heldt soils are in drainageways and on alluvial fans.

This unit is used as rangeland. These droughty soils are better suited to habitat for rangeland wildlife, such as antelope, cottontail, coyotes, and scaled quail, than to other kinds of wildlife habitat. Forage production typically is low. Proper management of livestock grazing can improve the habitat. Livestock watering facilities are used by various wildlife species.

Where this unit is irrigated, providing food and cover improves the habitat for openland wildlife. A system of conservation tillage leaves stubble and waste grain on the surface and helps to control erosion.

This unit is poorly suited to homesite development. The main management concerns are the clayey texture, the depth to shale, the slope, and the salinity.

11. Stoneham-Razor-Ulm

Nearly level to sloping, moderately deep and deep, well drained soils that formed in mixed material

This map unit is in the western part of the survey area. It is mainly in undulating to rolling areas. The landscape is characterized by moderately dissected drainageways, a few small areas of saline soils, a few areas of shale outcrop, and gravelly points and knobs. Slope is 0 to 15 percent. The vegetation is mainly short and mid grasses. Elevation is 4,200 to 4,750 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 6 percent of the survey area. It is about 35 percent Stoneham soils, 20 percent Razor soils, 15 percent Ulm soils, and 30 percent soils of minor extent.

Stoneham soils are on hills, ridges, and side slopes. They are deep. They formed in mixed medium textured material derived dominantly from sedimentary rock. They are medium textured throughout.

Razor soils are on ridges and side slopes. They are moderately deep. They formed in residuum derived dominantly from shale. They are clayey throughout. Weathered shale is at a depth of 20 to 40 inches. These soils are slightly affected by salts and alkali.

Ulm soils are on side slopes and in drainageways. They are deep. They formed in medium textured or moderately fine textured alluvium derived dominantly from sedimentary rock. The surface layer is loamy. The subsoil is clayey. Below this to a depth of 60 inches or more is loamy material.

Of minor extent in this unit are Olney, Fort Collins, Vona, Arvada, Manzanola, Midway, and Schamber soils. Fort Collins and Manzanola soils are on side slopes and terraces. Arvada soils are on valley bottoms, stream terraces, and fans. Olney and Vona soils are on ridges, hills, and side slopes. Midway and Schamber soils are on slope breaks, knobs, and points.

This unit is used mainly as rangeland. It also is used as nonirrigated cropland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves

stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is moderately suited to nonirrigated crops where slopes are less than 6 percent. The main management concerns are low fertility, salinity, and the hazard of erosion.

This unit is moderately suited to homesite development. The main limitation is the clayey texture. Careful site selection and onsite investigation are needed.

12. Kim-Pultney

Sloping, deep and moderately deep, well drained, calcareous soils that formed in mixed loamy material or in material weathered from medium textured, soft shale

This map unit is in the south-central part of the survey area. It is mainly on side slopes and foot slopes. The landscape is characterized by catsteps on the upper slopes and by smooth foot slopes. Slope is 1 to 9 percent. The vegetation is mainly short and mid grasses. Elevation is 4,100 to 4,300 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 0.2 percent of the survey area. It is about 40 percent Kim soils, 35 percent Pultney soils, and 25 percent soils of minor extent.

Kim soils are on slope breaks and the upper side slopes. They are deep. They formed in mixed loamy material derived dominantly from loess and sedimentary rock. They are loamy throughout.

Pultney soils are on side slopes and foot slopes. They are moderately deep. They formed in residuum derived dominantly from varicolored, medium textured, soft shale. About 50 percent of the surface is covered with scattered gravel containing ironstone and gypsum. The surface layer is loamy. Below this to a depth of 20 to 40 inches is medium textured or moderately fine textured material. Weathered shale is at a depth of 20 to 40 inches.

Of minor extent in this unit are Stoneham, Vona, Olney, and Fort Collins soils and shale outcrop. Stoneham, Vona, and Olney soils and the shale outcrop are on slope breaks and the upper side slopes. Fort Collins soils are on foot slopes.

Most areas of this unit are used as rangeland. A few are used as nonirrigated cropland.

Wildlife habitat is an important use of this unit. The unit is best suited to openland and rangeland wildlife habitat. In areas of cropland, habitat that favors ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Providing undisturbed nesting cover for pheasants is vital, especially in extensive areas of cropland. A system of conservation tillage that leaves stubble and waste grain on the surface helps to control erosion and provides food and cover for wildlife. The habitat for rangeland wildlife, such as pronghorn antelope, can be improved by developing livestock watering facilities, properly managing livestock grazing, and reseeding rangeland where needed.

This unit is poorly suited to nonirrigated crops. The main management concerns are the moderate depth to bedrock in some areas, low fertility, and a moderate hazard of erosion.

Nearly Level Soils That Formed in Alluvium

These soils make up about 3 percent of the survey area. The native vegetation is mainly grass. Elevation is 3,900 to 4,800 feet. The average annual precipitation is about 13 to 17 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

These soils are deep and somewhat excessively drained to poorly drained. They formed in alluvium derived dominantly from mixed material. They are used mainly as rangeland. A few areas are used as cropland.

13. Bankard-Fluvaquents

Nearly level, deep, somewhat excessively drained, somewhat poorly drained, and poorly drained soils that formed in sandy to clayey alluvium

This map unit is throughout the survey area. It is mainly on low terraces adjacent to the major drainageways, which are moderately dissected. Many areas show evidence of past flooding. Slope is 0 to 1 percent. The vegetation on the Bankard soils is mainly grass, sagebrush, and forbs. The vegetation on the Fluvaquents is mainly grass, sedges, and reeds. Elevation is 3,900 to 4,600 feet. The average annual precipitation is about 13 to 17 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 2 percent of the survey area. It is about 45 percent Bankard soils, 15 percent Fluvaquents, and 40 percent soils of minor extent.

Bankard soils are on low terraces and fans adjacent to drainageways. They are somewhat excessively drained. They formed in alluvium derived dominantly from mixed sandy material. The surface layer is moderately coarse textured. Below this to a depth of 60 inches or more is coarse textured material.

Fluvaquents are on low terraces adjacent to the major drainageways. These soils are somewhat poorly drained and poorly drained. They formed in alluvium derived dominantly from mixed material. The soil properties vary from one area to another. A water table fluctuates between depths of 6 and 24 inches. In areas near Big Sandy and Rush Creeks, these soils are moderately affected by salts and alkali.

Of minor extent in this unit are Glenberg, Haverson, Sampson, and Heldt soils. Glenberg soils are adjacent to the Bankard soils. They are generally farther from the drainageways than those soils and are less affected by flooding. Haverson, Sampson, and Heldt soils are in areas of medium textured and fine textured alluvium.

Most areas of this unit are used as rangeland. A few are used as cropland or hay meadows. About 10 percent of the acreage is used as nonirrigated cropland, and 5 percent is used as irrigated cropland.

The areas used as rangeland provide limited wildlife habitat because they are sparsely vegetated. Proper management of livestock grazing improves the habitat. Nonirrigated areas are best suited to habitat for openland and rangeland wildlife, such as jackrabbit, cottontail, and coyotes. Deer commonly use the draws for escape cover and as travel lanes. Ring-necked pheasant, migrating waterfowl and geese, and numerous songbirds frequent areas where crop residue is on the surface.

This unit is poorly suited to homesite development. The main management concern is the hazard of flooding.

14. Arvada-Manzanola

Nearly level, deep, well drained soils that formed in fine textured alluvium that is moderately high in content of soluble salts

This map unit is in the western part of the survey area. It is mainly on foot slopes and valley bottoms. The landscape is characterized by salt-tolerant vegetation and few to many slick spots. Slope is 0 to 3 percent. The vegetation is mainly grass. Elevation is 4,100 to 4,800 feet. The average annual precipitation is about 13 to 15 inches, the average annual air temperature is 58 degrees F, and the average frost-free season is 154 days.

This unit makes up about 1 percent of the survey area. It is about 40 percent Arvada soils, 40 percent Manzanola soils, and 20 percent soils of minor extent.

Arvada soils are on nearly level valley bottoms, fans, and stream terraces. They formed in fine textured alluvium derived dominantly from shale. The surface layer is moderately fine textured. Below this to a depth of 60 inches or more is fine textured material. These soils are strongly affected by salts and alkali.

Manzanola soils are on fans, terraces, and slightly convex or gently sloping valley side slopes. They formed in alluvium derived dominantly from shale. The surface layer is moderately fine textured. The subsoil is fine textured. Below this to a depth of 60 inches or more is moderately fine textured or medium textured material. These soils are slightly or moderately affected by salts and alkali.

Of minor extent in this unit are Firstview, Olney, Deertrail, Ulm, Nunn, and Fort Collins soils. Firstview soils are on valley bottoms in and near the sandhills. Olney and Fort Collins soils are on gently sloping hills and ridges. Deertrail soils are adjacent to the Arvada soils. Ulm and Nunn soils are on gently sloping foot slopes and valley bottoms.

This unit is used mainly as rangeland. A few areas are used as nonirrigated cropland.

The areas used as rangeland provide limited wildlife habitat because they are sparsely vegetated. Proper management of livestock grazing improves the habitat. Nonirrigated areas are best suited to habitat for openland and rangeland wildlife, such as jackrabbit, cottontail, and coyotes. Deer commonly use the draws for escape cover and as travel lanes. Ring-necked pheasant, migrating waterfowl and geese, and numerous songbirds frequent areas where crop residue is on the surface.

This unit is moderately suited or poorly suited to homesite development. The main management concerns are the clayey texture and the salinity.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ascalon sandy loam, 0 to 3 percent slopes, is a phase of the Ascalon series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Colby-Satanta complex, 5 to 12 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

1—Apishapa Family, ponded. These deep, somewhat poorly drained, clayey soils are in small, closed basins on large upland flats. They formed in mixed alluvium. During most years, shallow ponding is of long enough duration to limit plant growth. The average annual precipitation is 13 to 17 inches. Slopes are 0 to 1 percent.

These soils vary from one area to another, but they generally have a 1- to 4-inch surface layer of loam or clay loam and a deep substratum of clay loam or clay.

Included in this unit are small areas of Satanta loam, Goshen silt loam, and Manzanola clay loam. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Apishapa Family. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very slow or ponded, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly as native pasture. The Apishapa Family soils serve as watering areas when wet and produce some western wheatgrass, saltgrass, and forbs as they dry. Annual forage production ranges from 800 to 1,800 pounds per acre.

Where surrounding areas are dry-farmed, this unit is cultivated when dry enough to be tilled and to produce an occasional crop. In some areas a pit is dug on the lowest part of the landscape. The pit provides stock water and speeds drainage of the surrounding area. Because of the content of clay and the added moisture, extra care is needed when the soils are tilled.

These soils are in the playa, or shallow water, areas that form temporary wetlands following snowmelt and periods of precipitation. They generally are wet for only brief periods and are used heavily by migrating waterfowl and shore birds. The areas of rangeland typically are grazed heavily. The grazing generally limits the development of a vegetative cover. The areas of cropland commonly are farmed when the soils are dry enough to support farming equipment. During the wetter years, the cropland is not farmed and can be of high value as a source of food and cover for wildlife, especially migrating waterfowl and shore birds.

These soils are unsuited to urban structures, septic tank absorption fields, roads, and windbreaks because of the content of clay and the ponding.

The land capability subclass is VIw, nonirrigated. The range site is Plains Swale.

2—Arvada-Deertrail complex, 0 to 1 percent slopes. These deep, well drained soils are on valley bottoms, stream terraces, and fans. The native vegetation is mainly mid and short grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 40 percent Arvada clay loam and 35 percent Deertrail loam.

Included in this unit are small areas of Manzanola clay loam, Nunn clay loam, and Firstview sandy loam. Included areas make up about 25 percent of the total acreage.

The Arvada soil formed in clayey alluvium derived dominantly from shale. Typically, the surface layer is grayish brown, calcareous clay loam 2 inches thick. The upper 8 inches of the subsoil is dark brown, calcareous clay loam. The lower 5 inches is pale brown, calcareous silty clay loam. The substratum to a depth of 60 inches or more also is pale brown, calcareous silty clay loam.

The Deertrail soil formed in clayey alluvium derived dominantly from shale. Typically, the surface layer is dark brown loam 2 inches thick. The upper 5 inches of the subsoil is grayish brown clay loam. The lower 18 inches is pale brown and very pale brown, calcareous silty clay loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Permeability is very slow in the Arvada soil and slow in the Deertrail soil. Available water capacity is moderate in both soils because of a high content of salts. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. The soils are subject to rare flooding of brief duration in spring and summer. They are affected by alkali.

These soils are used as native rangeland and as wildlife habitat.

The potential plant community on the Arvada soil is mainly alkali sacaton, blue grama, and western wheatgrass. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds per acre.

The potential plant community on the Deertrail soil is mainly alkali sacaton, blue grama, western wheatgrass, and galleta. The average annual production of air-dry vegetation ranges from 700 to 2,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. The suitability for range seeding is moderate. The main limitation is the content of alkali and salts. These soils should be seeded to adapted grasses. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

These soils are poorly suited to windbreaks and environmental plantings and to homesite development. The main limitations on homesites are the potential for shrinking and swelling, a low load-bearing capacity, and the slow or very slow permeability.

The land capability subclass is VIIs, nonirrigated. The Arvada soil is in the Salt Flat range site, and the Deertrail soil is in the Alkaline Plains range site.

3—Ascalon sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on upland plains, hill slopes, and ridges. It formed in mixed eolian and alluvial material. The native vegetation is mainly mid and short grasses. The average annual precipitation is about 15 to 17 inches.

Typically, the surface layer is brown sandy loam 6 inches thick. The upper 13 inches of the subsoil is brown sandy clay loam. The lower 16 inches is pale brown, calcareous sandy clay loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous sandy loam.

Included in this unit are small areas of Manter sandy loam, Satanta loam, and Vona loamy sand. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ascalon soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as nonirrigated cropland. It also is used for irrigated cropland or as native rangeland. It is well suited to cultivated crops. It is limited mainly by moderate droughtiness and the moderate hazard of soil blowing. Because the amount

of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Tillage should be kept to a minimum. Soil blowing can be controlled by returning crop residue to the soil and by minimizing tillage. Stripcropping and field windbreaks help to control soil blowing and conserve moisture.

If this soil is used for irrigated crops, the main limitations are the hazard of soil blowing and the uneven terrain. Sprinkler irrigation is the best irrigation method because it permits an even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. Furrow irrigation is suitable. The efficient application and removal of irrigation water require leveling in the more sloping areas.

The main management needs are the proper use of irrigation water and measures that maintain soil fertility and control soil blowing. Irrigation water should be applied at a rate that ensures optimum production without increasing deep percolation or the hazards of runoff and erosion. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and helps to maintain tilth and the organic matter content. Applications of manure and commercial fertilizer that contains nitrogen and phosphorus help to maintain the productivity of the soil.

The potential plant community on this soil is mainly needleandthread, prairie sandreed, sideoats grama, and blue grama. Other grasses that characterize this site are thickspike wheatgrass and sand bluestem. The average annual production of air-dry vegetation is 800 to 2,300 pounds per acre.

This soil is well suited to windbreaks and environmental plantings. The main limitations are droughtiness and the hazard of erosion. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Irrigation may be needed when the seedlings are planted and during dry periods. Among the trees that are suitable for planting are eastern redcedar, Siberian elm, Russian olive, and ponderosa pine. Among the shrubs are lilac, skunkbush sumac, and American plum.

This soil is well suited to homesite development. It has few limitations. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. The hazard of erosion is increased if the surface is exposed during site development. Revegetating disturbed areas as soon as possible helps to control soil blowing.

A good plant cover can be established and maintained by applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for shrubs, vines, shade trees, and ornamental trees. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The land capability subclass is IIe, irrigated, and IIIe, nonirrigated. The range site is Sandy Plains.

4—Ascalon sandy loam, 3 to 5 percent slopes. This deep, well drained soil is on upland plains, hills, and ridges. It formed in mixed eolian and alluvial material. The native vegetation is mainly grasses. The average annual precipitation is about 15 to 17 inches.

Typically, the surface layer is brown sandy loam about 6 inches thick. The upper 13 inches of the subsoil is brown sandy clay loam. The lower 16 inches is pale brown, calcareous sandy clay loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous sandy loam.

Included in this unit are small areas of Manter sandy loam and Satanta sandy loam. The Manter soil has less clay in the subsoil than the Ascalon soil, and the Satanta soil has less sand. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ascalon soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used mainly as rangeland, nonirrigated cropland, or irrigated cropland. Wheat and millet are the dominant nonirrigated crops. The moisture supply is insufficient to permit annual cropping without irrigation. The best cropping system is one that includes small grain and summer fallow.

Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Stubble-mulch tillage, stripcropping, and chemical fallow can help to conserve soil moisture and control soil blowing and water erosion. Terraces and contour farming help to control runoff and conserve water.

Circular sprinkler systems are the most common irrigation methods used on this soil. The management needs in irrigated areas include the proper use of irrigation water and measures that maintain soil fertility and control erosion. Sufficient cover should be left on the surface to control soil blowing. Crops usually respond well to heavy applications of nitrogen and moderate applications of phosphorus. Applications of iron and zinc also may be needed.

The potential plant community on this soil is mainly needleandthread, prairie sandreed, sideoats grama, and blue grama. Other grasses that characterize this site

are thickspike wheatgrass and sand bluestem. The average annual production of air-dry vegetation is 800 to 2,300 pounds per acre.

This soil generally is suited to windbreaks and environmental plantings if an adequate amount of moisture is provided. Irrigation may be needed when seedlings are planted and during dry periods. Drip irrigation systems accelerate growth, increase the seedling survival rate, and prolong the life of the windbreak. The trees can be planted in diversion channels, where additional moisture is available. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, pinyon pine, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to homesite development.

The land capability subclass is IIIe, irrigated, and IVe, nonirrigated. The range site is Sandy Plains.

5—Ascalon-Eckley complex, 5 to 20 percent slopes. These deep, well drained soils are on upland plains, hills, and ridges, generally adjacent to drainageways. The native vegetation is mainly grasses. The average annual precipitation is about 15 to 17 inches.

This unit is 50 percent Ascalon sandy loam and 35 percent Eckley gravelly sandy loam.

Included in this unit are areas of Manter sandy loam, which makes up about 15 percent of the total acreage.

The Ascalon soil formed in mixed eolian and alluvial material that is calcareous. Typically, the surface layer is brown sandy loam about 6 inches thick. The upper 13 inches of the subsoil is brown sandy clay loam. The lower 16 inches is pale brown, calcareous sandy clay loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous sandy loam.

Permeability is moderate in the Ascalon soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

The Eckley soil formed in a thin layer of mixed loamy material over sand and gravel. Typically, the surface layer is brown gravelly sandy loam about 4 inches thick. The upper 8 inches of the subsoil is dark grayish brown gravelly sandy clay loam. The lower 4 inches is brown very gravelly sandy loam. The substratum to a depth of 60 inches or more is yellowish brown very gravelly sand.

Permeability is moderate in the subsoil of the Eckley soil and rapid or very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

These soils are used mainly as rangeland.

The potential plant community on the Ascalon soil is mainly blue grama and prairie sandreed. Other plants that characterize this site are thickspike wheatgrass, sideoats grama, sand bluestem, needleandthread, and sand sagebrush. The average annual production of air-dry vegetation is 800 to 2,300 pounds per acre.

The potential plant community on the Eckley soil is mainly blue grama, little bluestem, and sideoats grama. Other plants that characterize this site are needleandthread and prairie sandreed. The average annual production of air-dry vegetation ranges from 600 to 1,400 pounds per acre.

Establishing windbreaks and environmental plantings on this unit is difficult because of the low available water capacity of the Eckley soil and low precipitation. Seedlings can survive relatively well after their roots have grown enough to use the moisture deeper in the sand and gravel. Special management is necessary, including irrigation and planting on the contour. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, pinyon pine, ponderosa pine, and Siberian elm. Among the shrubs are skunkbush sumac and lilac.

These soils are moderately well suited to homesite development. The main limitation is the slope. Because of the rapid or very rapid permeability in the substratum of the Eckley soil, the effluent from septic tank absorption fields can pollute shallow wells.

The land capability subclass is VIe, nonirrigated. The Ascalon soil is in the Sandy Plains range site, and the Eckley soil is in the Gravel Breaks range site.

6—Baca silt loam, 0 to 3 percent slopes. This deep, well drained soil is on plains and in swales on uplands. It formed in silty loess derived dominantly from calcareous eolian material. The vegetation in uncultivated areas is mainly short grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is brown silt loam 6 inches thick. The upper 13 inches of the subsoil is brown silty clay loam. The lower 6 inches is grayish brown, calcareous silt loam. The substratum to a depth of 60 inches or more is pale brown, calcareous silt loam.

Included in this unit are small areas of Wiley and Weld silt loams. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Baca soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used as nonirrigated cropland or as native rangeland. It is well suited to nonirrigated crops. The main limitations are low precipitation, a low content of organic matter, and the hazard of soil blowing. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and helps to maintain tilth and the organic matter content. Tillage should minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre. If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate of the soil. They are especially effective if the range is in poor or fair condition.

Range seeding is suitable if the range is in poor condition. The main limitations are low precipitation and the hazard of soil blowing. Planting the seeds in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Irrigation is needed when the seedlings are planted and during dry periods. Among the trees that are suitable for planting are Russian olive, Siberian elm, ponderosa pine, and juniper. Among the shrubs are lilac, American plum, Siberian peashrub, and skunkbush sumac.

This soil is moderately well suited to homesite development. The main limitations are the content of clay in the subsoil and the hazard of soil blowing. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

The hazard of erosion is increased if the surface is exposed during site development. Revegetating disturbed areas as soon as possible helps to control soil blowing. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

Special management is needed if this soil is used as a site for septic tank absorption fields. The absorption lines should be installed below the moderately slowly permeable layer. Increasing the size of the absorption area, backfilling the trench with sandy material, and installing long absorption lines can help to compensate for the restricted permeability.

The land capability subclass is IVe, nonirrigated. The range site is Loamy Plains.

7—Bijou loamy sand, 0 to 3 percent slopes. This deep, somewhat excessively drained soil is in sandhill valleys and on foot slopes. It formed in noncalcareous eolian and alluvial material. The native vegetation is mainly grasses and sagebrush. The average annual precipitation is 13 to 15 inches.

Typically, the surface layer is grayish brown loamy sand about 5 inches thick. The upper 8 inches of the subsoil is brown sandy loam. The lower 5 inches is yellowish brown loamy sand. The substratum to a depth of 60 inches is brown sand.

Included in this unit are small areas of Vona loamy sand, Valent loamy sand, Sundance loamy sand, and Olney sandy loam. Included areas make up about 30 percent of the total acreage.

Permeability is moderately rapid in the Bijou soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This soil is used mainly as native rangeland or as wildlife habitat. In a few areas it is cropped along with other soils.

The potential plant community on this soil is mainly sand bluestem, sand dropseed, prairie sandreed, and blue grama. Sand sagebrush is common. The average annual production of air-dry vegetation is 800 to 2,000 pounds per acre.

This soil is moderately suited to range seeding. The main problems are droughtiness and the hazard of soil blowing. Ground cover is essential. Seeding in the stubble of the preceding crop helps to preserve the ground cover. The stubble traps snow and thus increases the moisture supply. When preparation of a seedbed is not advisable, interseeding may be needed.

Management practices should include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control. Because of the hazard of seepage, this soil is limited as a site for livestock watering ponds and other water impoundments.

If this soil is used for windbreaks, the main problems are droughtiness and the hazard of soil blowing. This hazard can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Planting in furrows or ditches can increase the supply of available moisture. Irrigation is needed when the seedlings are planted and during dry periods. Among the trees that are suitable for planting are Siberian elm, Russian olive, Rocky Mountain juniper, and ponderosa pine. Among the shrubs are skunkbush sumac, sand cherry, lilac, and American plum.

This soil is well suited to homesite development. The main limitations are the instability of cutbanks, soil blowing, and the moderately rapid permeability. The hazard of soil blowing is increased if the surface is exposed during site development. Revegetating disturbed areas as soon as possible reduces this hazard. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. In summer, irrigation is required in areas used for lawns, shrubs, vines, shade trees, and ornamental trees. If the density of housing is moderate to high, community sewage systems are needed to prevent the contamination of water supplies resulting from seepage.

The land capability subclass is IVe, nonirrigated. The range site is Sandy Plains.

8—Colby silt loam, 1 to 4 percent slopes, eroded. This deep, well drained soil is on ridges and hills. It formed in silty loess. The native vegetation is mainly grasses. The average annual precipitation is 13 to 17 inches.

Typically, the surface layer is grayish brown, calcareous silt loam about 3 inches thick. The next 9 inches is light brownish gray, calcareous silt loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Included in this unit are areas of Keith and Ulysses silt loams, which make up 10 percent of the unit, and Wiley silt loam, which makes up 20 percent. The Keith and Ulysses soils contain more organic matter in the surface layer than the Colby soil. The Wiley soil has a subsoil.

Permeability is moderate in the Colby soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used mainly as rangeland or as irrigated or nonirrigated cropland. Wheat and millet are the dominant nonirrigated crops. The moisture supply is insufficient to permit annual cropping without irrigation.

Cultivated areas commonly are severely eroded. Where erosion has occurred, the highly calcareous substratum is at the surface. A high content of lime decreases the available supply of most plant nutrients. Chlorosis is apparent, particularly in sorghum. Where erosion is severe, the surface is noticeably a lighter color, especially on ridges.

The management needs in irrigated areas are the proper use of irrigation water and measures that maintain soil fertility and control erosion. Returning crop residue to the soil and increasing the organic matter content can improve water infiltration and tilth and control erosion. Crops usually respond well to heavy applications of nitrogen and moderate applications of phosphorus. Application of iron and zinc may also be needed.

The management needs in nonirrigated areas include measures that maintain soil fertility, control erosion, and conserve moisture. Stubble-mulch and minimum tillage conserve soil moisture and reduce the hazard of erosion. Returning crop residue to the soil improves water infiltration and tilth and helps to control erosion. Terraces are helpful in controlling runoff. Where flat-channel terraces are used, applications of fertilizer that contains nitrogen and phosphorus are needed in the channels.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and sideoats grama. Other grasses that characterize this site are green needlegrass, needleandthread, buffalograss, and sand dropseed. The average annual production of air-dry vegetation is 600 to 1,600 pounds per acre.

Range seeding facilitates revegetation in areas depleted by overgrazing, cultivation, or other kinds of surface disturbance. Stock water development, fencing, and deferred grazing improve the distribution of grazing and maintain the range condition. Contour furrowing and pitting improve water infiltration and help to control runoff. They are especially effective if the range is in poor or fair condition.

Establishing windbreaks and environmental plantings is difficult on this soil. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, and continued cultivation for weed control can help to ensure that seedlings become established and survive. The trees can be planted in diversion channels, where additional moisture is available. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is suited to homesite development. The main limitation is low soil strength.

The land capability subclass is IIIe, irrigated, and IVe, nonirrigated. The range site is Loamy Plains.

9—Colby silt loam, 4 to 12 percent slopes. This deep, well drained soil is on ridges and hills. It formed in silty loess. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 17 inches.

Typically, the surface layer is grayish brown, calcareous silt loam about 3 inches thick. The next 9 inches is light brownish gray, calcareous silt loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Included in this unit are areas of Kim loam, Wiley silt loam, and Satanta loam. The Kim and Satanta soils contain more sand than the Colby soil. Also, the Satanta soil has a thicker, darker surface layer. The Wiley soil has a subsoil. The Kim soil makes up about 20 percent of the total acreage, the Wiley soil about 10 percent, and the Satanta soil about 5 percent.

Permeability is moderate in the Colby soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

This soil is used mainly as rangeland. Because of the erosion hazard, nonirrigated farming is impractical. Water commonly accumulates in the circular wheel tracks of sprinkler systems, causing the formation of gullies.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. Other grasses that characterize this site are sideoats grama and buffalograss. Such plants as pricklypear, snakeweed, wormwood, and yucca also grow on the site. The average annual production of air-dry vegetation is 500 to 1,200 pounds per acre.

This soil is poorly suited to windbreaks and environmental plantings. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, and continued cultivation for weed control help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this soil is used for homesite development, the main limitations are low soil strength and the slope.

The land capability subclass is VIe, nonirrigated. The range site is Loamy Slopes.

10—Colby-Satanta complex, 5 to 12 percent slopes. These deep, well drained soils are on uplands, side slopes, ridges, and high stream terraces. The native vegetation is mainly grasses. The average annual precipitation is about 15 to 17 inches.

This unit is about 30 percent Colby silt loam and 30 percent Satanta loam. The Colby soil is on ridges and mid slopes. The Satanta soil is on foot slopes and in swales.

Included in this unit is Manter sandy loam, which makes up about 15 percent of the total acreage. Also included are small areas of Eckley gravelly sandy loam and Sampson loam. Included areas make up about 40 percent of the total acreage.

The Colby soil formed in silty loess on ridges and side slopes in the uplands. Slope is 5 to 12 percent. Typically, the surface layer is grayish brown, calcareous silt loam about 3 inches thick. The next 9 inches is light brownish gray, calcareous silt loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

The Satanta soil formed in mixed loess and alluvium on uplands and high stream terraces. Slope is 5 to 9 percent. Typically, the surface layer is grayish brown and brown loam about 8 inches thick. The upper 8 inches of the subsoil is brown clay loam. The lower 12 inches is pale brown and very pale brown, calcareous loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous loam.

Permeability is moderate in the Colby and Satanta soils. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

These soils are used mainly as rangeland. Because of the erosion hazard, nonirrigated farming is impractical. Irrigation also is impractical. Water commonly accumulates in the circular wheel tracks of sprinkler systems, causing the formation of gullies. If possible, a better suited soil should be selected for irrigation.

These soils are well suited to native pasture. They occur as moderately sloping and strongly sloping, rough, broken areas of grassland adjacent to the loamy plains.

The potential plant community on the Colby soil is mainly blue grama, western wheatgrass, and green needlegrass. Other grasses that characterize this site are buffalograss and sideoats grama. Such plants as pricklypear, snakeweed, wormwood, and yucca also grow on the site. The average annual production of air-dry vegetation is 500 to 1,200 pounds per acre.

The potential plant community on the Satanta soil is mainly blue grama, western wheatgrass, needleandthread, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,650 pounds per acre.

Proper grazing management is essential on both soils. Where the soils are eroding and the stand of

grasses is seriously depleted, mechanical treatment and reseeding may be needed to restore productivity and control further erosion. Gullies can form in areas dissected by cattle trails.

Establishing windbreaks and environmental plantings is difficult on these soils because of the slope. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, and continued cultivation for weed control help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If these soils are used for homesite development, the main limitations are low soil strength, slope, and high erodibility. Proper engineering designs and practices can overcome these limitations.

The land capability subclass is VIe, nonirrigated. The Colby soil is in the Loamy Slopes range site, and the Satanta soil is in the Loamy Plains range site.

11—Firstview sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on terraces, fans, and valley bottoms. It formed in clayey alluvium overlain by mixed sandy material derived dominantly from soft shale and from areas of sandy eolian material. The vegetation in uncultivated areas is mainly grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is grayish brown sandy loam about 6 inches thick. The upper 21 inches of the subsoil is grayish brown, calcareous sandy loam, sandy clay loam, and clay loam. The lower 31 inches is pale brown, calcareous clay. The substratum to a depth of 60 inches is very pale brown sandy clay loam.

Included in this unit are small areas of Arvada clay loam, Olney sandy loam, and Manzanola clay loam. Included areas make up about 40 percent of the total acreage.

Permeability is moderate to a depth of 20 to 40 inches in the Firstview soil and slow in the lower part of the profile. Available water capacity is high for salt-tolerant plants. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to ponding, and some areas along drainageways are flooded briefly during some years. The soil is affected by salts and alkali.

This soil is used as native rangeland or as wildlife habitat. The vegetation in most areas is mainly alkali sacaton, blue grama, western wheatgrass, switchgrass, and sand bluestem. Sand sagebrush also is common. The average annual production of air-dry vegetation ranges from 700 to 2,200 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. The suitability of this soil for range seeding is moderate. The main problems are alkalinity, salinity, and the hazard of soil blowing. Loss of the surface layer severely decreases the ability of the soil to produce plants suitable for grazing. The plants selected for seeding should be those that are tolerant of salts and alkali.

This soil is poorly suited to windbreaks and environmental plantings and to homesite development.

The land capability subclass is VIIs, nonirrigated. The range site is Sandy Salt Flat.

12—Fluvaquents, 0 to 1 percent slopes. These deep, somewhat poorly drained and poorly drained soils are on long, generally narrow, low alluvial terraces. They formed in recent alluvium. The native vegetation is mainly grasses. The average annual precipitation is 13 to 17 inches.

Typically, the surface layer is dark gray loam about 10 inches thick. The substratum is stratified sand to clay. It has reddish brown and olive yellow mottles in the upper 10 to 24 inches and is gleyed at a depth of 20 to 30 inches.

Included in this unit are small areas of Haverson loam, Glenberg sandy loam, Bankard loamy sand, Heldt clay loam, and stratified loams and sandy loams that are deeper to the water table than the Fluvaquents. Included areas make up about 20 percent of the total acreage.

Permeability is moderate above the water table in the Fluvaquents. Available water capacity is high. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is slight. Flooding is frequent. A seasonal high water table fluctuates between depths of 6 and 24 inches in spring and early summer.

These soils are used mainly as native pasture, but some of the larger areas are used for native hay or alfalfa. The potential plant community is mainly alkali sacaton, switchgrass, and western wheatgrass. The average annual production of air-dry vegetation is about 1,000 to 3,000 pounds per acre.

These soils are poorly suited to homesite development. The main problem is the flooding. If drained, some areas are a fair source of sand and gravel.

The land capability subclass is VIw, nonirrigated. The range site is Salt Meadow.

13—Fort Collins loam, 0 to 3 percent slopes. This deep, well drained soil is on terraces and alluvial fans. It formed in calcareous loess and alluvium derived dominantly from mixed material. The vegetation in uncultivated areas is mainly short grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is brown loam 5 inches thick. The upper 13 inches of the subsoil is brown clay loam. The lower 10 inches is pale brown, calcareous clay loam. The upper 14 inches of the substratum is very pale brown, calcareous silt loam. The lower part to a depth of 60 inches or more is light yellowish brown, calcareous loam. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Stoneham loam, Wiley silt loam, and Manzanola clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Fort Collins soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as nonirrigated cropland. It also is used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by occasional periods of droughtiness, which increase the hazard of soil blowing and the loss of organic matter. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 800 to 1,600 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. The suitability of this soil for range seeding is good. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble traps snow and thus increases the moisture supply. Chiseling and pitting increase the rate of infiltration. They are especially beneficial if the range is in poor condition.

This soil is well suited to windbreaks and environmental plantings. Planting on the contour conserves moisture. Irrigation may be needed when seedlings are planted and during dry periods. Among the trees that are suitable for planting are eastern redcedar, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, and American plum.

This soil is well suited to homesite development. The hazard of erosion is increased if the surface is exposed. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Revegetating disturbed areas as soon as possible helps to control soil blowing. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

The land capability subclass is IVe, nonirrigated. The range site is Loamy Plains.

14—Fort Collins-Vona complex, 0 to 3 percent slopes. These deep soils are in areas on uplands where sandy material has been deposited over loamy material. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

This unit is about 50 percent Fort Collins loam and 40 percent Vona loamy sand. The Fort Collins soil is on flats and in drainageways. The Vona soil is on small ridges and hills.

Included in this unit are small areas of Manzanola and Olney soils. Included areas make up about 10 percent of the total acreage.

The Fort Collins soil is well drained. It formed in mixed loess and alluvium on upland plains. Typically, the surface layer is brown loam about 5 inches thick. The upper 13 inches of the subsoil is brown clay loam. The lower 10 inches is pale brown, calcareous clay loam. The upper 14 inches of the substratum is very pale brown, calcareous silt loam. The lower part to a depth of 60 inches or more is light yellowish brown, calcareous loam.

Permeability is moderate in the Fort Collins soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

The Vona soil is somewhat excessively drained. It formed in mixed sandy and silty eolian material. Typically, the surface layer is grayish brown loamy sand about 4 inches thick. The upper 6 inches of the subsoil is brown sandy loam. The lower 10 inches is pale brown, calcareous sandy loam. The substratum to a

depth of 60 inches or more is pale brown, calcareous loamy sand.

Permeability is moderately rapid in the Vona soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

These soils are used mainly as rangeland or as nonirrigated cropland. Control of soil blowing and conservation of moisture are important management concerns in the areas of nonirrigated cropland. Stubble-mulch tillage and stripcropping can conserve moisture and reduce the hazards of soil blowing and water erosion.

The potential plant community on the Fort Collins soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation is 800 to 1,600 pounds per acre.

The potential plant community on the Vona soil is mainly prairie sandreed, blue grama, little bluestem, and sideoats grama. The average annual production of air-dry vegetation ranges from 900 to 2,200 pounds per acre.

Range seeding is a suitable practice if the range is in poor condition. If the range is severely eroded and blowouts have formed, applications of fertilizer are needed in newly seeded areas. Planting in sorghum, millet, sudan, or small grain stubble helps to protect the new seedlings. The use of interseeding equipment may be desirable if the potential for crop failure is serious.

These soils are generally well suited to windbreaks and environmental plantings. Additional moisture is needed, however, for long-term survival. The trees can be planted in diversion channels, where additional moisture is available, or the site can be irrigated. Drip irrigation systems work effectively. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, and continued cultivation for weed control can help to ensure that seedlings become established and survive. Seedlings should be protected from wind and wildlife. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

These soils have good potential for building site development and onsite sewage disposal. On sites for buildings and roads, measures that overcome moderately low soil strength are needed. The soils are well suited to septic tank absorption fields.

The land capability subclass is IVe, nonirrigated. The Fort Collins soil is in the Loamy Plains range site, and the Vona soil is in the Sandy Plains range site.

15—Glenberg-Bankard complex, 0 to 1 percent slopes. These deep soils are on flood plains and terraces along the major drainageways. They are occasionally flooded. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 17 inches.

This unit is about 65 percent Glenberg sandy loam and about 25 percent Bankard loamy sand.

Included in this unit are small areas of Haverson loam and a loamy soil that is shallow to sand and gravel. The Haverson soil contains more clay than the Glenberg and Bankard soils. Included areas make up about 10 percent of the total acreage.

The Glenberg soil is well drained. It formed in sandy alluvium along intermittent streams. Typically, the surface layer is brown sandy loam about 10 inches thick. The substratum to a depth of 60 inches or more is brown and pale brown, stratified sandy loam and loamy sand.

Permeability is moderately rapid in the Glenberg soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. Streambank cutting can be a problem. The soil is subject to rare flooding. Stream channels can change course during the periods of flooding. The hazard of soil blowing is high.

The Bankard soil is somewhat excessively drained. It formed in sandy alluvium on low terraces and fans bordering intermittent drainageways. Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The substratum to a depth of 60 inches or more is stratified loamy sand to gravelly sand.

Permeability is rapid in the Bankard soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The soil is occasionally flooded. Streambank cutting can be a problem during the periods of flooding. The hazard of soil blowing is high.

These soils are used mainly as rangeland. They are in narrow, elongated areas, nearly all of which are managed along with the finer textured surrounding soils.

The potential plant community on the Glenberg soil is mainly switchgrass, prairie sandreed, sand bluestem, and needlegrass. Other plants that characterize this site are sand sagebrush and yucca. The average annual production of air-dry vegetation is 1,300 to 2,500 pounds per acre.

The potential plant community on the Bankard soil is mainly switchgrass, needleandthread, sand bluestem, and prairie sandreed. The average annual production of air-dry vegetation ranges from 750 to 2,500 pounds per acre.

These soils generally are not suited to windbreaks or

to homesite development, septic tank absorption fields, or other urban uses because of droughtiness and the hazards of flooding and soil blowing.

The land capability subclass is VIe, nonirrigated. The range site is Sandy Bottomland.

16—Goshen silt loam, 0 to 1 percent slopes. This deep, well drained soil is in swales and drainageways. It formed in calcareous, silty material derived dominantly from water-reworked eolian deposits. The vegetation in uncultivated areas is mainly mid and short grasses. Areas are elongated and are 20 to 160 acres in size. The average annual precipitation is about 15 to 17 inches.

Typically, the surface layer is brown silt loam 4 inches thick. The upper 17 inches of the subsoil is dark brown silty clay loam. The lower 14 inches is brown and pale brown silt loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Included in this unit are small areas of Keith silt loam, Richfield silt loam, Sampson loam, and Satanta loam. Included areas make up about 30 percent of the total acreage.

Permeability is moderate in the Goshen soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to rare flooding.

This soil is used mainly as rangeland. It also is used as nonirrigated or irrigated cropland.

The potential plant community on this soil is mainly western wheatgrass, green needlegrass, switchgrass, and blue grama. The average annual production of air-dry vegetation ranges from 1,200 to 2,800 pounds per acre. If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained.

The suitability of this soil for range seeding is good. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the moisture supply. Chiseling and pitting improve the infiltration of water. They are especially effective if the range is in poor condition. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

This soil is well suited to nonirrigated crops. It is limited mainly by occasional periods of droughtiness, which increase the hazard of soil blowing, and by brief periods of flooding. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

Some areas of this soil are irrigated. Both sprinkler and furrow irrigation systems are suitable. The main management needs are the proper use of irrigation water and measures that maintain fertility and control soil blowing. Irrigation water should be applied at a rate that ensures optimum production without increasing the hazards of deep percolation, runoff, and erosion. For the efficient application and removal of irrigation water, leveling is needed in the more sloping areas. Applications of manure and commercial fertilizer that contains nitrogen and phosphorus help to maintain the productivity of the soil. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water intake. Soil blowing can be controlled by keeping the surface rough and cloddy when it is not protected by vegetation.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Irrigation may be needed when seedlings are planted and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is poorly suited to homesite development. The main hazards are the flooding and the seepage of effluent in septic tank absorption fields. Dikes and channels that have floodwater outlets can protect buildings and onsite sewage disposal systems from flooding.

The land capability subclass is IIe, irrigated, and IIIe, nonirrigated. The range site is Overflow.

17—Haverson loam, 0 to 1 percent slopes. This deep, well drained soil is along drainageways on stream terraces and flood plains. It formed in medium textured alluvium. The native vegetation is mainly grasses. The average annual precipitation is 13 to 17 inches.

Typically, the surface layer is light brownish gray loam about 5 inches thick. The substratum to a depth of 60 inches is stratified, calcareous clay loam, sandy loam, and loam.

Included in this unit are small areas of Glenberg sandy loam and Bankard loamy sand. Included areas

make up about 20 percent of the total acreage.

Permeability is moderate in the Haverson soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. Gully bank cutting is a problem in some areas. This soil is occasionally flooded.

This soil is used mainly for grazing or nonirrigated crops. A few areas are irrigated by sprinklers. Wheat is the dominant nonirrigated crop. Alfalfa generally can grow on this soil, but establishing a stand is difficult. Corn is the dominant irrigated crop.

The grassland commonly is subject to heavy livestock use because of the lushness of the vegetation and the proximity to watering sites. Control of soil blowing and conservation of moisture are important management concerns in areas of nonirrigated cropland. Applying a system of stubble-mulch tillage and maintaining crop residue on or near the surface can help to control runoff and soil blowing and maintain tilth and the organic matter content. Tillage should be minimized. The flooding sometimes damages crops.

The potential plant community on this soil is western wheatgrass, green needlegrass, switchgrass, and blue grama. Other grasses that characterize this site are big bluestem and buffalograss. The average annual production of air-dry vegetation is 1,200 to 2,800 pounds per acre.

This soil generally is suited to windbreaks and environmental plantings if an adequate amount of moisture is provided. Soil blowing is the main hazard when the trees and shrubs are planted and during the early growth stages. Irrigation may be needed when seedlings are planted and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil has poor potential for urban development because of the occasional flooding. Detailed hydrologic studies are needed before any structure is located on this soil. In some areas gully cutting has reduced the flooding frequency.

The land capability subclass is IIe, irrigated, and IVe, nonirrigated. The range site is Overflow.

18—Heldt clay loam, 0 to 1 percent slopes. This deep, well drained soil is on terraces and alluvial fans. It formed in fine textured alluvium derived dominantly from soft shale. The native vegetation is mainly mid and short grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is light brownish gray clay loam 5 inches thick. The upper 10 inches of the subsoil is grayish brown, calcareous clay. The lower 13 inches is light olive brown, calcareous clay. The substratum to a depth of 60 inches or more is light gray, calcareous clay.

Included in this unit are small areas of Manzanola, Ulm, Nunn, and Arvada soils. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Heldt soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to rare flooding.

This soil is used as native rangeland. The potential plant community is mainly blue grama, western wheatgrass, and alkali sacaton. The average annual production of air-dry vegetation ranges from 500 to 1,300 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. Chiseling and pitting improve the infiltration of water. They are especially effective if the range is in poor condition.

Range seeding is a suitable practice if the range is in poor condition. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the moisture supply. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This soil is moderately well suited to windbreaks and environmental plantings. The main limitation is the content of clay, salts, and alkali. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Siberian elm, Russian olive, and Rocky Mountain juniper. Among the shrubs are lilac, Hansen rose, Siberian peashrub, and skunkbush sumac.

This soil is poorly suited to homesite development. The main limitations are a high shrink-swell potential, the slow permeability, and the rare flooding.

The land capability subclass is IVs, nonirrigated. The range site is Clayey Plains.

19—Keith-Richfield silt loams, 0 to 2 percent slopes. These deep, well drained soils are on uplands. The native vegetation is mainly short and mid grasses.

Figure 2.—Harvesting winter wheat in an area of Keith-Richfield silt loams, 0 to 2 percent slopes, near the Kit Carson County line.

The average annual precipitation is about 15 to 17 inches.

This unit is 50 percent Keith silt loam and 30 percent Richfield silt loam.

Included in this unit are small areas of Goshen, Ulysses, and Satanta silt loams. Included areas make up about 20 percent of the total acreage.

The Keith soil formed in calcareous, silty loess derived dominantly from sedimentary rock. Typically, the surface layer is grayish brown silt loam 6 inches thick. The upper 4 inches of the subsoil is grayish brown silty clay loam. The lower 15 inches is light brownish gray silty clay loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

The Richfield soil formed in calcareous, silty loess derived dominantly from sedimentary rock. Typically, the surface layer is brown silt loam 6 inches thick. The upper 12 inches of the subsoil is brown silty clay loam. The lower 6 inches is pale brown, calcareous silty clay loam. The substratum to a depth of 60 inches or more is light gray, calcareous silt loam.

Permeability is moderate in the Keith soil and moderately slow in the Richfield soil. Available water capacity is high in both soils. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

These soils are used mainly as nonirrigated cropland (fig. 2). They also are used as irrigated cropland and as rangeland.

These soils are well suited to nonirrigated crops. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Soil blowing can be controlled by keeping the surface rough and cloddy when it is not protected by vegetation. Tillage should be minimized.

The practices that can help to control erosion include early fall seeding, stubble-mulch tillage, terraces, diversions, and grassed waterways. A tillage pan forms easily if the soils are tilled when wet. Chiseling or subsoiling breaks up the pan.

These soils are well suited to irrigated crops. There are few limitations in irrigated areas. Sprinkler, furrow, or border irrigation systems can be used.

The main management concerns are the proper use of irrigation water and measures that maintain fertility

and control soil blowing. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the needs of the crop. For the efficient application and removal of irrigation water, leveling is needed in the more sloping areas. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the water intake rate. Applications of manure and commercial fertilizer that contains nitrogen and phosphorus help to maintain soil productivity.

If the range vegetation on the Keith soil is in excellent condition, the native grasses are mainly western wheatgrass, blue grama, and green needlegrass. The average annual production of air-dry vegetation ranges from 1,000 to 1,800 pounds per acre.

The potential plant community on the Richfield soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 900 to 1,700 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained.

Range seeding is a suitable practice if the range is in poor condition. The main problems are low precipitation and the hazard of soil blowing. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the moisture supply.

These soils are well suited to windbreaks and environmental plantings. Irrigation may be needed when seedlings are planted and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are lilac, skunkbush sumac, American plum, and Siberian peashrub.

If these soils are used for homesite development, the main management concerns are the hazard of soil blowing and a moderate shrink-swell potential. The design of buildings and roads should minimize the effects of shrinking and swelling. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling. Preserving the existing plant cover during construction helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

Special treatment is needed if the Richfield soil is used as a site for septic tank absorption fields. The absorption lines should be installed below the moderately slowly permeable layer. Increasing the size of the absorption area helps to compensate for the restricted permeability.

The land capability subclass is IIe, irrigated, and IIIe, nonirrigated. The range site is Loamy Plains.

20—Keith-Ulysses silt loams, 1 to 4 percent slopes. These deep, well drained soils are on uplands. The native vegetation is mainly grasses. The average annual precipitation is about 15 to 17 inches.

This unit is 45 percent Keith soil and 30 percent Ulysses soil. The Keith soil is in nearly level and concave areas. The Ulysses soil is on side slopes and in convex areas.

Included in this unit are small areas of Colby, Wiley, Richfield, and Goshen soils. Included areas make up about 25 percent of the total acreage.

The Keith soil formed in loess derived dominantly from calcareous sedimentary material. Slope is 1 to 2 percent. Typically, the surface layer is grayish brown silt loam about 6 inches thick. The upper 4 inches of the subsoil is grayish brown silty clay loam. The lower 15 inches is light brownish gray silty clay loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Permeability is moderate in the Keith soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

The Ulysses soil formed in loess derived dominantly from calcareous sedimentary material. Slope is 2 to 4 percent. Typically, the surface layer is grayish brown silt loam about 3 inches thick. The upper 5 inches of the subsoil is dark grayish brown, calcareous silt loam. The lower 4 inches is pale brown, calcareous silt loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Permeability is moderate in the Ulysses soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

These soils are used mainly as nonirrigated cropland. They also are used as irrigated cropland or as native range.

These soils are well suited to both nonirrigated and irrigated crops. Wheat and millet are the dominant nonirrigated crops. Because the amount of precipitation

is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Soil blowing can be controlled by returning crop residue to the soil and by minimizing tillage. Terracing and stripcropping between alternate terraces conserve moisture and reduce the hazards of water erosion and soil blowing.

Sprinkler and furrow systems are the main irrigation methods used on these soils. Corn and alfalfa are the primary irrigated crops. For the efficient application and removal of irrigation water, leveling is needed in the more sloping areas. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the water intake rate. Crops respond well to nitrogen and phosphate fertilizer. Irrigation water should be applied at a rate that ensures optimum production without increasing the hazards of deep percolation, runoff, and erosion.

The potential plant community on these soils is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation is about 600 to 1,700 pounds per acre.

Range seeding is a suitable practice if the range is in poor condition. The main management concerns are low precipitation and the hazard of soil blowing. Summer fallow and planting into small grain or millet stubble increase the supply of available moisture and help to control soil blowing.

If these soils are used for windbreaks and environmental plantings, the main problems are low precipitation and soil blowing. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Irrigation may be needed when seedlings are planted and during dry periods. Planting on the contour conserves moisture. Among the trees that are suitable for planting are Siberian elm, Russian olive, ponderosa pine, and eastern redcedar. Among the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If these soils are used for homesite development or other kinds of urban development, the main limitations are moderately low soil strength, a moderate potential for frost action, and the moderate hazard of soil blowing. Properly designing and reinforcing footings and foundations can help to overcome these limitations. Buildings should be designed so that water is kept away from the foundations. Revegetating disturbed areas as soon as possible helps to control soil blowing. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The land capability subclass is IIe, irrigated, and IVe, nonirrigated. The range site is Loamy Plains.

21—Kim loam, 1 to 3 percent slopes, eroded. This deep, well drained soil is on hills and ridges. It formed in mixed material. The native vegetation is mainly grasses. The average annual precipitation is 13 to 17 inches.

Typically, the surface layer is light brownish gray, calcareous loam about 7 inches thick. The upper 23 inches of the substratum is very pale brown, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, calcareous sandy clay loam.

Included in this unit are small areas of Fort Collins and Stoneham soils. These soils have a subsoil. They make up about 15 percent of the total acreage.

Permeability is moderate in the Kim soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used mainly as rangeland. A few areas are used as nonirrigated cropland. Wheat and millet are the dominant nonirrigated crops.

Cultivated areas commonly are severely eroded. The highly calcareous substratum is at the surface in these severely eroded areas. A high content of lime decreases the available supply of most plant nutrients. Chlorosis is apparent, particularly in sorghum. Where erosion is severe, the surface is noticeably lighter in color, especially on ridges.

Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Stubble-mulch tillage and stripcropping can conserve moisture and reduce the hazards of water erosion and soil blowing. Minimum tillage conserves crop residue. Terraces are helpful in controlling runoff. Where flat-channel terraces are used, applications of fertilizer that contains nitrogen and phosphorus are needed in the channels.

The potential plant community on this soil is mainly blue grama and western wheatgrass. Other grasses that characterize this site are green needlegrass, sand dropseed, and needleandthread. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre.

Establishing windbreaks and environmental plantings on this soil is difficult. Additional moisture is needed for long-term survival. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, contour planting in diversion channels, and continued cultivation for weed control can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac,

lilac, Siberian peashrub, and American plum.

This soil is well suited to urban development. It has only minor limitations, which are easily overcome. The hazard of soil blowing is the chief management concern.

The land capability subclass is IVe, nonirrigated. The range site is Loamy Plains.

22—Kim loam, 3 to 12 percent slopes. This deep, well drained soil is on hills and ridges. It formed in mixed material. The native vegetation is mainly grasses. The average annual precipitation is 13 to 17 inches.

Typically, the surface layer is grayish brown and light brownish gray, calcareous loam about 7 inches thick. The upper 23 inches of the substratum is very pale brown, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, calcareous sandy clay loam.

Included in this unit are small areas of Stoneham and Fort Collins loams. These soils have a subsoil. They make up about 15 percent of the acreage.

Permeability is moderate in the Kim soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

This soil is used mainly as rangeland. A few areas are used as nonirrigated cropland. Intensive management is needed to control erosion on the cropland.

The potential plant community on this soil is mainly blue grama and western wheatgrass. Other grasses that characterize this site are needleandthread and sideoats grama. The average annual production of air-dry vegetation ranges from 450 to 1,200 pounds per acre.

Establishing windbreaks and environmental plantings on this soil is difficult because of the scarcity of moisture and the slope. Additional moisture is needed for long-term survival. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, contour planting in diversion channels, and continued cultivation for weed control can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is moderately well suited to homesite development. The primary limitations are the erosion hazard and the slope. These limitations can be overcome if care is taken during construction.

The land capability subclass is VIe, nonirrigated. The range site is Loamy Slopes.

23—Kim-Canyon loams, 2 to 5 percent slopes. These well drained soils are on hills and ridges. The native vegetation is mainly short and mid grasses. The average annual precipitation is 15 to 17 inches.

This unit is 40 percent Kim soil and 20 percent Canyon soil.

Included in this unit are small areas of Stoneham loam, Satanta loam, Wiley silt loam, and Rock outcrop. Included areas make up about 40 percent of the total acreage.

The Kim soil is deep. It formed in mixed, medium textured material derived dominantly from sedimentary rock and loess. Typically, the surface layer is grayish brown and light brownish gray, calcareous loam 7 inches thick. The upper 23 inches of the substratum is very pale brown, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, calcareous sandy clay loam.

Permeability is moderate in the Kim soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Canyon soil is shallow. It formed in residuum derived dominantly from calcareous, weathered sandstone. Typically, the surface layer is grayish brown, calcareous loam 3 inches thick. The subsurface layer is gray, calcareous gravelly loam 4 inches thick. The substratum is light brownish gray, calcareous gravelly loam 6 inches thick. It is underlain by highly fractured, calcareous sandstone.

Permeability is moderate in the Canyon soil. Available water capacity is very low. The effective rooting depth is 6 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

These soils are used as rangeland or as nonirrigated cropland.

The potential plant community on the Kim soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre.

The potential plant community on the Canyon soil is mainly little bluestem, sideoats grama, and blue grama. Other plants that characterize this site are threadleaf sedge, needleandthread, and western wheatgrass. The average annual production of air-dry vegetation ranges from 550 to 1,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained.

The suitability of these soils for range seeding is moderate. The main limitations are the shallowness and droughtiness of the Canyon soil. The included Rock outcrop also is a limitation.

Loss of the surface layer through erosion severely decreases the ability of these soils to produce plants suitable for grazing. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble traps snow and thus increases the supply of moisture. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Properly managing livestock grazing helps to prevent excessive erosion.

These soils are moderately well suited to nonirrigated crops. The main limitations are the shallowness and droughtiness of the Canyon soil. The included Rock outcrop also is a limitation. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. The soils should be tilled on the contour or across the slope.

These soils are moderately well suited to windbreaks and environmental plantings. The main limitations are the shallowness and droughtiness of the Canyon soil and the moderate hazard of erosion on both soils. Irrigation is needed when seedlings are planted and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Russian olive, Siberian elm, and eastern redcedar. Among the shrubs are skunkbush sumac, Hansen rose, and lilac.

The Kim soil is well suited to homesite development, but the Canyon soil is poorly suited. Cuts made to provide essentially level building sites can expose bedrock. Preserving the existing plant cover during construction helps to control erosion. Revegetating disturbed areas as soon as possible helps to control soil blowing.

Selection of adapted vegetation is critical in areas used for lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The land capability subclass is IVe, nonirrigated. The Kim soil is in the Loamy Plains range site, and the Canyon soil is in the Limestone Breaks range site.

24—Kim-Canyon loams, 5 to 35 percent slopes. These well drained soils are on ridges and hill slopes. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 15 to 17 inches.

This unit is 40 percent Kim soil and 25 percent Canyon soil.

Included in this unit are small areas of Stoneham loam, Rock outcrop, Satanta loam, and Colby silt loam. Included areas make up about 35 percent of the total acreage.

The Kim soil is deep. It formed in mixed, medium textured material derived dominantly from sedimentary rock and loess. Slope is 5 to 20 percent. Typically, the surface layer is grayish brown and light brownish gray, calcareous loam 7 inches thick. The upper 23 inches of the substratum is very pale brown, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, calcareous sandy clay loam.

Permeability is moderate in the Kim soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

The Canyon soil is shallow. It formed in residuum derived dominantly from calcareous, weathered sandstone. Slope is 5 to 35 percent. Typically, the surface layer is grayish brown, calcareous loam 3 inches thick. The subsurface layer is gray, calcareous gravelly loam 4 inches thick. The substratum is light brownish gray, calcareous gravelly loam 6 inches thick. It is underlain by highly fractured, calcareous sandstone.

Permeability is moderate in the Canyon soil. Available water capacity is low. The effective rooting depth is 6 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

These soils are used as native rangeland.

The potential plant community on the Kim soil is mainly blue grama, western wheatgrass, needleandthread, and sideoats grama. The average annual production of air-dry vegetation ranges from 450 to 1,200 pounds per acre.

The potential plant community on the Canyon soil is mainly little bluestem, sideoats grama, and blue grama. The average annual production of air-dry vegetation ranges from 550 to 1,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. The suitability for range seeding is poor. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. Properly managing livestock grazing helps to prevent excessive

erosion. Loss of the surface layer through erosion severely decreases the ability of the soils to produce plants suitable for grazing.

These soils are poorly suited to windbreaks and environmental plantings. The main limitations are the slope and hazard of erosion in areas of both soils and the shallowness and droughtiness of the Canyon soil.

These soils are poorly suited to homesite development. The main limitations are the slope and hazard of erosion in areas of both soils and the depth to bedrock in the Canyon soil.

The land capability subclass is VIe, nonirrigated. The Kim soil is in the Loamy Slopes range site, and the Canyon soil is in the Limestone Breaks range site.

25—Kim-Midway complex, 6 to 15 percent slopes. These well drained soils are on hills and ridges. Areas are long and irregular in shape and are 20 to 120 acres in size. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 30 percent Kim loam and 30 percent Midway clay loam. The Kim soil is in the upper, more sloping areas. The Midway soil is on side slopes.

Included in this unit are small areas of Razor clay loam, Stoneham loam, Manzanola clay loam, Ulm loam, and Schamber soils. The nearly level Stoneham soil is on hilltops and side slopes. Included areas make up about 40 percent of the total acreage.

The Kim soil is deep. It formed in calcareous loess and alluvium derived dominantly from mixed sources. Typically, the surface layer is grayish brown and light brownish gray, calcareous loam 7 inches thick. The upper 23 inches of the substratum is very pale brown, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, calcareous sandy clay loam.

Permeability is moderate in the Kim soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

The Midway soil is shallow. It formed in clayey residuum derived dominantly from soft shale. Typically, the surface layer is pale brown, calcareous clay loam 2 inches thick. The upper 5 inches of the substratum is light brownish gray, calcareous clay. The lower 6 inches is light gray, calcareous clay. Soft, clayey shale is at a depth of about 13 inches.

Permeability is slow in the Midway soil. Available water capacity is low. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

These soils are used mainly as native rangeland or as wildlife habitat. A few areas are used as nonirrigated cropland.

The potential plant community on the Kim soil is mainly blue grama, western wheatgrass, needleandthread, and sideoats grama. The average annual production of air-dry vegetation ranges from 450 to 1,200 pounds per acre.

The potential plant community on the Midway soil is mainly alkali sacaton, western wheatgrass, blue grama, and sideoats grama. The average annual production of air-dry vegetation ranges from 300 to 950 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. The suitability for range seeding is poor. The main limitations are the slope, the rapid runoff, the slow permeability, and the hazard of erosion. Properly managing livestock grazing helps to prevent excessive erosion. Loss of the surface layer through erosion severely decreases the ability of the soils to produce plants suitable for grazing.

These soils are poorly suited to windbreaks and environmental plantings. The main limitations are the shallowness and low available water capacity of the Midway soil and the slope of both soils.

These soils are poorly suited to homesite development. The main limitations are the shallowness and shrink-swell potential of the Midway soil and the erosion hazard and slope of both soils.

The land capability subclass is VIe, nonirrigated. The Kim soil is in the Loamy Slopes range site, and the Midway soil is in the Shaly Plains range site.

26—Kim-Pultney complex, 1 to 9 percent slopes. These well drained soils are on hills and ridges. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 50 percent Kim soil and 25 percent Pultney soil.

Included in this unit are small areas of Stoneham loam, Midway clay loam, and Otero sandy loam. Included areas make up about 25 percent of the total acreage.

The Kim soil is deep. It formed in mixed loamy material derived dominantly from sedimentary rock and loess. Slope is 1 to 9 percent. Typically, the surface layer is grayish brown and light brownish gray, calcareous loam 7 inches thick. The upper 23 inches of the substratum is very pale brown, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, calcareous sandy clay loam.

Permeability is moderate in the Kim soil. Available

water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The hazard of soil blowing is high.

The Pultney soil is moderately deep. It formed in calcareous residuum derived dominantly from soft shale. Slope is 2 to 9 percent. Typically, the surface layer is yellowish brown, calcareous very fine sandy loam 4 inches thick. The subsurface layer is yellowish brown, calcareous clay loam 4 inches thick. The upper 6 inches of the substratum is light yellowish brown, calcareous clay loam. The lower 16 inches is light brownish gray, calcareous clay loam. Soft shale is at a depth of about 30 inches.

Permeability is moderately slow to a depth of 20 to 40 inches in the Pultney soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The hazard of soil blowing is high.

These soils are used mainly as rangeland or as wildlife habitat. Some small areas are farmed along with larger areas of soils that have better potential for crops.

The potential plant community on these soils is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Measures that prevent excessive erosion are needed. Loss of the surface layer through erosion severely decreases the ability of the soils to produce plants suitable for grazing.

Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. Contour furrowing, ripping, and pitting help to control runoff and increase the rate of water intake. They are especially effective if the range is in poor or fair condition.

These soils are poorly suited to windbreaks and environmental plantings.

If these soils are used for homesite development, the main limitation is the shrink-swell potential of the Pultney soil. The damage caused by shrinking and swelling can be minimized by properly designing buildings, foundations, and sewage systems and by backfilling excavations with material that has a low shrink-swell potential.

The land capability subclass is VIe, nonirrigated. The range site is Loamy Plains.

27—Manter sandy loam, 1 to 3 percent slopes. This deep, well drained soil is on terraces and alluvial fans. It formed in mixed loess and sandy material derived dominantly from eolian and alluvial deposits. The vegetation in uncultivated areas is mainly mid and short grasses. Sagebrush is common. The average annual precipitation is about 15 to 17 inches.

Typically, the surface layer is dark grayish brown sandy loam 4 inches thick. The upper 12 inches of the subsoil is dark brown sandy loam. The next 4 inches is brown sandy loam. The upper 15 inches of the substratum is light gray, calcareous loamy fine sand. The lower part to a depth of 60 inches is very pale brown, calcareous loamy fine sand.

Included in this unit are small areas of Ascalon sandy loam and Satanta loam. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Manter soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as native rangeland. It also is used as nonirrigated or irrigated cropland.

The potential plant community on this soil is mainly prairie sandreed, blue grama, little bluestem, and switchgrass. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

Range seeding is suitable if the range is in poor condition. The range responds well to applications of fertilizer, range seeding, and proper grazing use. The main limitations are droughtiness and the hazard of soil blowing. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble traps snow and thus increases the moisture supply. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. The soil is limited as a site for livestock watering ponds and other water impoundments because of the hazard of seepage.

This soil is well suited to nonirrigated crops. The main limitations are droughtiness and the hazard of erosion. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. The best suited crops are those that are tolerant of drought.

Most other crops do not grow well because the supply of available moisture is not adequate. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

This soil is well suited to irrigated crops. Sprinkler irrigation is the best irrigation method because it permits an even, controlled application of water, helps to control runoff, and minimizes the risk of erosion.

Irrigation water should be applied at a rate that ensures optimum production without increasing the hazards of deep percolation, runoff, and erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the water intake rate. Leaving crop residue on or near the surface conserves moisture, helps to maintain tilth, and reduces the hazard of erosion.

This soil is well suited to windbreaks and environmental plantings. The main limitations are droughtiness and the hazard of soil blowing. Irrigation may be needed when seedlings are planted and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Siberian elm, hackberry, eastern redcedar, and ponderosa pine. Among the shrubs are Siberian peashrub, lilac, sand cherry, and American plum.

This soil is well suited to homesite development. Preserving the existing plant cover during construction helps to control erosion. In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating disturbed areas as soon as possible helps to control soil blowing.

A good plant cover can be established and maintained by properly applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

The land capability subclass is IIIe, irrigated and nonirrigated. The range site is Sandy Plains.

28—Manter sandy loam, 3 to 5 percent slopes. This deep, well drained soil is on hills, ridges, and the edges of terraces. It formed in mixed loess and sandy material derived dominantly from eolian and alluvial deposits. The vegetation in uncultivated areas is mainly mid and short grasses. Sagebrush is common. The average annual precipitation is about 15 to 17 inches.

Typically, the surface layer is dark grayish brown sandy loam 4 inches thick. The upper 12 inches of the subsoil is dark brown sandy loam. The lower 4 inches is brown sandy loam. The upper 15 inches of the substratum is light gray, calcareous loamy fine sand. The lower part to a depth of 60 inches is very pale brown, calcareous loamy fine sand.

Included in this unit are small areas of Ascalon sandy loam, Satanta loam, Eckley gravelly sandy loam, and Vona loamy sand. Included areas make up about 25 percent of the total acreage.

Permeability is moderately rapid in the Manter soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

This soil is used mainly as native rangeland. It also is used as nonirrigated or irrigated cropland.

The potential plant community on this soil is mainly prairie sandreed, blue grama, little bluestem, and switchgrass. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

Range seeding is a suitable practice if the range is in poor condition. The range responds well to applications of fertilizer, range seeding, and proper grazing use. The main limitations are droughtiness and the hazard of erosion. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble traps snow and thus increases the moisture supply. This soil is limited as a site for livestock watering ponds and other water impoundments because of the hazard of seepage.

This soil is suited to nonirrigated crops. The main limitations are droughtiness and the hazard of erosion.

Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. The best suited crops are those that are tolerant of drought. Other crops do not grow well because the supply of available moisture is not adequate. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

This soil is well suited to irrigated crops. Sprinkler

irrigation is the best irrigation method because it permits an even, controlled application of water, helps to control runoff, and minimizes the risk of erosion.

Irrigation water should be applied at a rate that ensures optimum production without increasing the hazards of deep percolation, runoff, and erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the water intake rate. Leaving crop residue on or near the surface helps to conserve moisture, maintain tilth, and control erosion.

This soil is well suited to windbreaks and environmental plantings. The main limitations are droughtiness and the hazard of erosion. Irrigation may be needed when seedlings are planted and during dry periods. Planting on the contour conserves moisture. Summer fallow, cultivation for weed control, and selection of adapted plants help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are hackberry, Russian olive, Rocky Mountain juniper, and ponderosa pine. Among the shrubs are lilac, Siberian peashrub, American plum, and multiflora rose.

This soil is well suited to homesite development. Preserving the existing plant cover during construction helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating disturbed areas as soon as possible helps to control soil blowing. A good plant cover can be established and maintained by properly applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

The land capability subclass is IIIe, irrigated, and IVe, nonirrigated. The range site is Sandy Plains.

29—Manter sandy loam, 5 to 15 percent slopes. This deep, well drained soil is on ridges, hills, and the edges of terraces. It formed in mixed loess and sandy material derived dominantly from eolian and alluvial deposits. The native vegetation is mainly mid and short grasses. Sagebrush is common. The average annual precipitation is about 15 to 17 inches.

Typically, the surface layer is dark grayish brown sandy loam 4 inches thick. The upper 12 inches of the subsoil is dark brown sandy loam. The lower 4 inches is brown sandy loam. The upper 15 inches of the substratum is light gray, calcareous loamy fine sand. The lower part to a depth of 60 inches is very pale brown, calcareous loamy fine sand.

Included in this unit are small areas of Ascalon sandy loam, Valent loamy sand, Eckley gravelly sandy loam, and Vona loamy sand. Included areas make up about 35 percent of the total acreage.

Permeability is moderately rapid in the Manter soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used as native rangeland or wildlife habitat. The potential plant community is mainly prairie sandreed, blue grama, little bluestem, and switchgrass. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. This soil is limited as a site for livestock watering ponds and other water impoundments because of the hazard of seepage.

If this soil is used for windbreaks and environmental plantings, the main limitations are the slope, droughtiness, and the hazard of erosion. Irrigation may be needed when seedlings are planted and during dry periods. Planting on the contour conserves moisture. Among the trees that are suitable for planting are Siberian elm, Russian olive, eastern redcedar, and Austrian pine. Among the shrubs are lilac, American plum, Siberian peashrub, and multiflora rose.

This soil is moderately well suited to homesite development. The main limitations are the slope, the instability of cutbanks, the moderately rapid permeability, and the hazard of erosion. Preserving the existing plant cover during construction helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating disturbed areas as soon as possible helps to control soil blowing. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The slope is a management concern on sites for septic tank absorption fields. The absorption lines should be installed on the contour. The design of access roads should provide for an adequate cut-slope grade. Drains are needed to control runoff and keep soil losses to a minimum.

The land capability subclass is VIe, nonirrigated. The range site is Sandy Plains.

30—Manzanola clay loam, 0 to 3 percent slopes. This deep, well drained soil is on wide valley side slopes and on fans and terraces. It formed in fine textured alluvium derived dominantly from soft, calcareous shale. The native vegetation is mainly mid and short grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is light brownish gray, calcareous clay loam 5 inches thick. The upper 16 inches of the subsoil is pale brown, calcareous clay. The lower 5 inches is very pale brown, calcareous silty clay loam. The upper 10 inches of the substratum is light gray, calcareous silty clay loam. The lower part to a depth of 60 inches is light gray, calcareous clay loam.

Included in this unit are small areas of Ulm, Arvada, Fort Collins, and Razor soils. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Manzanola soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as native rangeland. It also is used as nonirrigated cropland.

The potential plant community on this soil is mainly western wheatgrass, alkali sacaton, blue grama, and fourwing saltbush. Other plants that characterize this site are buffalograss and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,800 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Range seeding is a suitable practice if the range is in poor condition. The main limitations are the content of salts and alkali and the content of clay. The species selected for planting should be those that are tolerant of salts and alkali. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the supply of moisture.

Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate. These measures are especially effective if the range is in poor or fair condition. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

This soil is moderately well suited to nonirrigated crops. It is limited mainly by the content of clay and of salts and alkali.

Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. A tillage pan forms easily if this soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Soil blowing can be controlled by keeping the surface rough and cloddy when it is not protected by vegetation and by planting crops in alternate strips at right angles to the prevailing wind. Tillage should be minimized.

This soil is moderately well suited to windbreaks and environmental plantings. The main limitations are the content of salts and alkali and the content of clay in the subsoil. Irrigation is needed when seedlings are planted and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Siberian elm, Russian olive, and eastern redcedar. Among the shrubs are lilac, American plum, and skunkbush.

This soil is poorly suited to homesite development. The main limitations are the slow permeability and the content of clay in the subsoil. A drainage system is needed if roads and building foundations are constructed. Excess water can be removed by properly designed drainage ditches. Revegetating disturbed areas as soon as possible helps to control soil blowing.

Properly designing buildings and roads helps to offset the limited ability of the soil to support a load. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

Because of the slow permeability, septic tank absorption fields do not function properly. Backfilling the trench with sandy material and installing long absorption lines can compensate for the restricted permeability.

Selection of adapted plants is critical in areas used for lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The land capability subclass is IVe, nonirrigated. The range site is Saline Overflow.

31—Nunn clay loam, 0 to 2 percent slopes. This deep, well drained soil is on fans and terraces. It formed in clayey alluvium. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 17 inches.

Typically, the surface layer is brown clay loam about 9 inches thick. The upper 10 inches of the subsoil is brown clay loam. The lower 8 inches is light brownish gray, calcareous clay loam. The upper 9 inches of the

substratum is light gray clay loam. The lower part to a depth of 60 inches or more is very pale brown, calcareous clay loam.

Included in this unit are small areas of Goshen silt loam, Satanta loam, Heldt clay loam, and Weld silt loam. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Nunn soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as cropland. Some areas are used as native range.

This soil is well suited to nonirrigated crops. It is limited mainly by the moderate hazard of soil blowing. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Maintaining crop residue on or near the surface helps to control runoff, reduces the hazard of soil blowing, and helps to maintain tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by keeping the surface rough and cloddy when it is not protected by vegetation.

If this soil is used as irrigated cropland, the main limitation is the slow permeability. A sprinkler system can be used. A slow application rate is needed to minimize runoff. If furrow or corrugation irrigation systems are used, the runs should be on the contour or across the slope. The main management needs are the proper use of irrigation water and measures that maintain fertility and control soil blowing.

The potential plant community on this soil is western wheatgrass, blue grama, and green needlegrass. The average annual production of air-dry vegetation is 600 to 1,300 pounds per acre.

Properly managing livestock grazing helps to prevent excessive erosion. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate. These measures are especially effective if the range is in poor or fair condition.

If the range has seriously deteriorated, seeding is necessary. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the moisture supply.

This soil is moderately suited to light construction, septic tank absorption fields, surfaced roads, and recreational uses. A high shrink-swell potential and the slow permeability are management concerns. The soil is well suited to sewage lagoons.

The land capability subclass is IIe, irrigated, and IIIe, nonirrigated. The range site is Clayey Plains.

32—Olney sandy loam, 1 to 6 percent slopes. This deep, well drained soil is on side slopes, ridges, and alluvial fans. It formed in mixed calcareous loess and sandy material derived dominantly from eolian and alluvial deposits. The native vegetation is mainly mid and short grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is brown sandy loam 4 inches thick. The upper 14 inches of the subsoil is yellowish brown and light yellowish brown sandy clay loam. The lower 5 inches is very pale brown sandy loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous sandy loam.

Included in this unit are small areas of Stoneham loam, Otero sandy loam, Manzanola clay loam, and Vona loamy sand. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Olney soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

This soil is used mainly as native rangeland. It also is used as nonirrigated cropland.

The potential plant community on this soil is mainly blue grama, prairie sandreed, sideoats grama, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds per acre.

The range responds well to applications of fertilizer, range seeding, and proper grazing use. The main limitations are the hazard of erosion and droughtiness. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the moisture supply. This soil is limited as a site for livestock watering ponds and other water impoundments because of the hazard of seepage.

This soil is moderately well suited to nonirrigated crops. The main limitations are the hazard of erosion and droughtiness. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow.

Maintaining crop residue on or near the surface helps to control runoff, reduces the hazard of soil blowing, and helps to maintain tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

This soil is moderately well suited to windbreaks and

environmental plantings. The main limitations are the hazard of erosion and droughtiness. Irrigation may be needed when seedlings are planted and during dry periods. Planting on the contour conserves moisture. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Siberian elm, Russian olive, Rocky Mountain juniper, and Austrian pine. Among the shrubs are lilac, Siberian peashrub, American plum, and sand cherry.

This soil is well suited to homesite development. Erosion is a hazard in the steeper areas. It can be controlled by disturbing only the part of the site that is used for construction and by preserving the existing plant cover during construction. In places excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Disturbed areas should be seeded as soon as possible. A good plant cover can be established and maintained by properly applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

The land capability subclass is IVe, nonirrigated. The range site is Sandy Plains.

33—Olney-Manzanola complex, 0 to 6 percent slopes. These deep, well drained soils are on hills and valley side slopes. The native vegetation is mainly short and mid grasses.

This unit is 45 percent Olney sandy loam and 35 percent Manzanola clay loam.

Included in this unit are areas of Fort Collins loam, Vona loamy sand, Ulm loam, Arvada clay loam, and Ulm loamy sand. Included areas make up about 20 percent of the total acreage.

The Olney soil formed in mixed calcareous loess and sandy material derived dominantly from eolian and alluvial deposits. Slope is 1 to 6 percent. Typically, the surface layer is brown sandy loam 4 inches thick. The upper 14 inches of the subsoil is yellowish brown and light yellowish brown sandy clay loam. The lower 5 inches is very pale brown sandy loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous sandy loam.

Permeability is moderate in the Olney soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

The Manzanola soil formed in clayey alluvium derived dominantly from mixed material. Slope is 0 to 3 percent. Typically, the surface layer is light brownish gray clay loam 5 inches thick. The upper 16 inches of the subsoil is pale brown, calcareous clay. The lower 5 inches is very pale brown, calcareous silty clay loam. The upper 10 inches of the substratum is light gray, calcareous silty clay loam. The lower part to a depth of 60 inches or more is light gray, calcareous clay loam.

Permeability is slow in the Manzanola soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

These soils are used as native pasture or as wildlife habitat.

The potential plant community on the Olney soil is mainly blue grama, prairie sandreed, sideoats grama, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds per acre.

The potential plant community on the Manzanola soil is mainly western wheatgrass, alkali sacaton, blue grama, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 800 to 2,800 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained.

Range seeding is a suitable practice if the range is in poor condition. The main limitations are droughtiness, the moderate hazard of erosion, and moderate salinity and alkalinity in the Manzanola soil. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the supply of moisture. Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate. These measures are especially effective if the range is in poor or fair condition.

If these soils are used for windbreaks and environmental plantings, the main limitations are the moderate hazard of soil blowing on both soils and the salinity and alkalinity of the Manzanola soil. Irrigation is needed when seedlings are planted and during dry periods. Summer fallow, cultivating for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Siberian elm, Russian olive, and eastern redcedar. Among the shrubs are skunkbush sumac, American plum, and sand cherry.

These soils are moderately well suited to homesite development. The main limitations are the shrink-swell potential of the Manzanola soil and the hazard of soil blowing on both soils. Properly designing foundations

and footings and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Septic tank absorption fields do not function properly on the Manzanola soil because of the slow permeability.

The land capability subclass is IVe. The Olney soil is in the Sandy Plains range site, and the Manzanola soil is in the Saline Overflow range site.

34—Otero-Olney sandy loams, 3 to 6 percent slopes, eroded. These deep, well drained soils are on uplands. The native vegetation is mainly mid and short grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 35 percent Otero sandy loam and 30 percent Olney sandy loam.

Included in this unit are small areas of Vona loamy sand, Bijou loamy sand, and Fort Collins loam. Included areas make up about 35 percent of the total acreage.

The Otero soil formed in mixed calcareous loess and alluvium derived dominantly from sedimentary rock. Typically, the surface layer is pale brown, calcareous sandy loam 5 inches thick. The subsoil is light yellowish brown, calcareous sandy loam 13 inches thick. The upper 21 inches of the substratum also is light yellowish brown, calcareous sandy loam. The lower part to a depth of 60 inches is very pale brown, calcareous sandy loam.

Permeability is moderately rapid in the Otero soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

The Olney soil formed in mixed silty and sandy, calcareous material derived dominantly from loess and alluvium. Typically, the surface layer is brown sandy loam 4 inches thick. The upper 4 inches of the subsoil is yellowish brown and light yellowish brown sandy clay loam. The lower 5 inches is very pale brown, calcareous sandy loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous sandy loam.

Permeability is moderate in the Olney soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

Most areas are or formerly were cultivated and are severely eroded. Many eroded areas have been seeded to grass or have revegetated naturally. The topography of the Otero soil is hummocky. It is characterized by small, dish-shaped blown-out areas. The Olney soil generally is on foot slopes and commonly has calcareous surface accumulations derived from the Otero soil. Natural fertility is low, particularly in the Otero soil. A high content of lime decreases the available supply of most plant nutrients. Chlorosis is apparent, particularly in sorghum.

These soils are used mainly as rangeland. They also are used as nonirrigated cropland along with soils that are better suited to crops.

The potential plant community on the Otero soil is mainly blue grama, prairie sandreed, needlegrass, and sideoats grama. Sagebrush is common. The average annual production of air-dry vegetation ranges from 1,000 to 1,800 pounds per acre.

The potential plant community on the Olney soil is mainly blue grama, prairie sandreed, sideoats grama, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained.

The range responds well to applications of fertilizer, range seeding, and proper grazing use. The main limitations are droughtiness and the hazard of soil blowing. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the supply of moisture. Interseeding is suitable in areas where seedbed preparation is not practical. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Properly managing livestock grazing helps to prevent excessive erosion. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. These soils are limited as sites for livestock watering ponds and other water impoundments because of the hazard of seepage.

If these soils are used as nonirrigated cropland, the main limitations are droughtiness and the hazard of soil blowing. Seeding disturbed areas to native or tame pasture plants helps to control soil blowing.

These soils are moderately well suited to windbreaks and environmental plantings. Soil blowing is a hazard before the trees and shrubs become established. It can be controlled by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Irrigation may be needed when seedlings are planted and during dry periods. Among the trees that are suitable for planting are Siberian elm, Russian olive, and Rocky Mountain juniper. Among the shrubs are lilac, sand cherry, and Hansen rose.

These soils are well suited to homesite development.

Soil blowing is the main hazard. Preserving the existing plant cover during construction and revegetating disturbed areas as soon as possible reduce this hazard. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Cutbanks are not stable and are subject to slumping.

A good plant cover can be established and maintained by properly applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

The land capability subclass is VIe, nonirrigated. The range site is Sandy Plains.

35—Razor clay loam, 1 to 6 percent slopes. This moderately deep, well drained soil is on ridges and side slopes. It formed in clayey residuum derived dominantly from soft shale. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is grayish brown clay loam 2 inches thick. The subsoil is about 13 inches of pale brown clay loam and clay. The substratum is light brownish gray, calcareous clay 15 inches thick. It is underlain by soft shale.

Included in this unit are small areas of Midway clay loam, Stoneham loam, and Manzanola clay loam. Included areas make up about 30 percent of the total acreage.

Permeability is slow in the Razor soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

This soil is used as native rangeland or as wildlife habitat. The potential plant community is mainly western wheatgrass, blue grama, and green needlegrass. The average annual production of air-dry vegetation ranges from 600 to 1,300 pounds per acre.

Range seeding is a suitable practice if the range is in poor condition. The main limitations are droughtiness and the hazard of erosion. Loss of the surface layer through erosion severely decreases the ability of the soil to produce plants suitable for grazing. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the supply of moisture. Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate. These measures are especially effective if the range is in poor or fair condition.

This soil is poorly suited to windbreaks and environmental plantings. The main limitations are droughtiness, the moderate depth to bedrock, and the content of clay. Irrigation is needed when seedlings are planted and during dry periods. Planting on the contour conserves moisture. Among the trees that are suitable for planting are Siberian elm, Russian olive, and eastern redcedar. Among the shrubs are lilac, American plum, and Siberian peashrub.

This soil is poorly suited to homesite development. The main limitations are the slow permeability and the potential for shrinking and swelling. Properly designing foundations and footings and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Cuts made to provide essentially level building sites can expose the bedrock. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Excavation for roads and buildings increases the hazards of water erosion and soil blowing. Revegetating disturbed areas as soon as possible helps to prevent excessive soil loss.

A good plant cover can be established and maintained by properly applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

This soil is poorly suited to septic tank absorption fields because of the slow permeability. Backfilling the trench with sandy material and installing long absorption lines help to compensate for the restricted permeability.

The land capability subclass is VIe, nonirrigated. The range site is Clayey Plains.

36—Razor-Midway clay loams, 6 to 12 percent slopes. These well drained soils are on the edges of benches and on ridges and side slopes. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 40 percent Razor clay loam and 30 percent Midway clay loam.

Included in this unit are small areas of Kim loam, Manzanola clay loam, shale outcrop, and shallow, gravelly soils. Included areas make up about 30 percent of the total acreage.

The Razor soil is moderately deep. It formed in clayey residuum derived dominantly from soft shale. Typically, the surface layer is grayish brown clay loam 2 inches thick. The subsoil is pale brown clay loam 9 inches thick. The substratum is pale brown and light brownish gray, calcareous clay 19 inches thick. It is underlain by soft shale.

Permeability is slow in the Razor soil. Available water capacity is moderate. The effective rooting depth is 20

to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Midway soil is shallow. It formed in clayey residuum derived dominantly from soft shale. Typically, the surface layer is pale brown, calcareous clay loam 2 inches thick. The subsoil is light brownish gray, calcareous clay 5 inches thick. The substratum is light gray, calcareous clay 6 inches thick. It is underlain by soft shale.

Permeability is slow in the Midway soil. Available water capacity is low. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

These soils are used as rangeland or as wildlife habitat.

The potential plant community on the Razor soil is mainly western wheatgrass, blue grama, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,100 pounds per acre.

The potential plant community on the Midway soil is mainly alkali sacaton, western wheatgrass, blue grama, and sideoats grama. The average annual production of air-dry vegetation ranges from 300 to 950 pounds per acre.

The production of vegetation suitable for grazing by livestock is limited by the slope and a slow water intake rate and by the low available water capacity of the Midway soil.

The suitability of these soils for range seeding is poor. The main limitations are the slope, the low available water capacity of the Midway soil, and the hazard of erosion. Loss of the surface layer through erosion severely decreases the ability of the soils to produce plants suitable for grazing. Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate. These measures are especially effective if the range is in poor or fair condition. Deferred grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

These soils are poorly suited to windbreaks and environmental plantings and to homesite development.

The land capability subclass is VIIe, nonirrigated. The Razor soil is in the Clayey Plains range site, and the Midway soil is in the Shaly Plains range site.

37—Sampson loam, 0 to 2 percent slopes. This deep, well drained soil is in swales and drainageways. It formed in calcareous, medium textured, mixed alluvium. The average annual precipitation is 13 to 17 inches. The vegetation in uncultivated areas is mainly short and mid grasses. Areas are elongated and are 20 to 160 acres in size.

Typically, the surface layer is dark grayish brown loam 5 inches thick. The upper 25 inches of the subsoil is brown clay loam. The lower 20 inches is brown, calcareous clay loam. The substratum to a depth of 78 inches or more is pale brown, calcareous loam.

Included in this unit are small areas of Goshen silt loam, Satanta loam, and Glenberg sandy loam. Included areas make up about 25 percent of the total acreage.

Permeability is moderate in the Sampson soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to rare flooding.

This soil is used mainly as rangeland. It also is used as nonirrigated or irrigated cropland.

The potential plant community is mainly western wheatgrass, switchgrass, green needlegrass, and big bluestem. The average annual production of air-dry vegetation ranges from 1,100 to 3,000 pounds per acre.

The suitability of this soil for range seeding is good. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow and thus increases the supply of moisture. Chiseling and pitting improve the infiltration of water. These measures are especially beneficial if the range is in poor condition.

This soil is well suited to nonirrigated crops. It is limited mainly by occasional periods of droughtiness, which increase the hazard of soil blowing, and by rare, brief periods of flooding. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

Some areas of this soil are irrigated. Both sprinkler and furrow irrigation systems are suitable. The main management concerns are the proper use of irrigation water and measures that maintain fertility and control soil blowing. Irrigation water should be applied at a rate that ensures optimum production without increasing the hazards of deep percolation, runoff, and erosion. For the efficient application and removal of irrigation water, leveling is needed in the more sloping areas. Applications of manure and commercial fertilizer that contains nitrogen and phosphorus help to maintain the productivity of the soil. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the water intake rate. Soil blowing can be controlled by keeping the surface rough and cloddy when it is not protected by vegetation.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, cultivating for

weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Irrigation may be needed when seedlings are planted and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is poorly suited to homesite development. The main hazards are flooding and seepage of effluent from septic tank absorption fields. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

The land capability subclass is IIe, irrigated, and IIIe, nonirrigated. The range site is Overflow.

38—Satanta loam, 0 to 3 percent slopes. This deep, well drained soil is on upland side slopes and high terraces, commonly near streams and rivers. It formed in mixed alluvium and eolian material. The native vegetation is mainly grasses. The average annual precipitation is about 15 to 17 inches.

Typically, the surface layer is grayish brown and brown loam about 8 inches thick. The upper 8 inches of the subsoil is brown clay loam. The lower 12 inches is pale brown and very pale brown, calcareous loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous loam.

Included in this unit are Ascalon sandy loam and Kim loam. The Ascalon soil is sandier than the Satanta soil. The Kim soil does not have a dark surface layer or a subsoil in which clay has accumulated. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Satanta soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as rangeland or as nonirrigated or irrigated cropland. Wheat and millet are the dominant nonirrigated crops. The supply of moisture is insufficient to permit annual cropping without irrigation.

Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Stubble-mulch tillage and stripcropping are needed. Subsurface tillage equipment, such as chisels, sweeps, and rod weeders, can be used effectively to maintain crop residue on the surface. Chemical weed control can complement a stubble-mulch program and minimize tillage. Chiseling or subsoiling can be effective in improving water infiltration. Terraces are helpful in controlling runoff. Where flat-channel terraces are used, applications of fertilizer that contains nitrogen and phosphorus are needed in the channels.

Border irrigation systems can be used on this soil, but land leveling generally is needed. Circular sprinkler systems are being used effectively. Corn is the dominant irrigated crop. A smaller acreage is used for wheat, sugar beets, alfalfa, pasture, or barley. The management needs in irrigated areas include the proper use of irrigation water and measures that maintain fertility, control erosion, minimize disease, and control insects. Crops generally respond well to heavy applications of nitrogen and moderate applications of phosphorus. Irrigation late in the fall allows the soil to store moisture throughout the profile. It is especially effective where a sprinkler system is used.

The potential plant community on this soil is mainly western wheatgrass, blue grama, needleandthread, and green needlegrass. Threeawn and sand dropseed increase in extent when the surface is disturbed. The average annual production of air-dry vegetation is 500 to 1,650 pounds per acre.

The primary management need in the areas of range is proper grazing use. Range seeding accelerates the revegetation of areas depleted by overgrazing, cultivation, or other practices that disturb the surface. Planting seeds in sorghum, millet, sudan, or small grain stubble helps to protect new seedlings from the wind. Stock water development, fencing, and deferred grazing can improve or maintain the range condition. Areas where the range is in poor or fair condition can be improved by contour furrowing or pitting.

This soil is suited to windbreaks and environmental plantings. Trees can be planted in diversion channels, where additional moisture is available. Also, irrigation water can be applied. Drip irrigation systems work effectively. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, and continued cultivation for weed control can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is well suited to homesite development and other kinds of urban development. Properly designing foundations and roads helps to overcome moderately low soil strength.

The land capability subclass is IIe, irrigated, and IIIe, nonirrigated. The range site is Loamy Plains.

39—Satanta-Colby complex, 3 to 5 percent slopes. These deep, well drained soils are on upland side slopes and stream terraces. The native vegetation is

mainly grasses. The average annual precipitation is about 15 to 17 inches.

This unit is 50 percent Satanta loam and 20 percent Colby loam. The Satanta soil is on valley side slopes. The Colby soil is on ridges, knobs, and slope breaks.

Included in this unit is Manter sandy loam and small areas of Sampson loam. Included areas make up about 30 percent of the total acreage.

The Satanta soil formed in mixed alluvium and eolian material. Typically, the surface layer is grayish brown and brown loam about 8 inches thick. The upper 8 inches of the subsoil is brown clay loam. The lower 12 inches is pale brown and very pale brown, calcareous loam. The substratum to a depth of 60 inches is very pale brown, calcareous loam.

Permeability is moderate in the Satanta soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

The Colby soil formed in loess. Typically, the surface layer is grayish brown, calcareous silt loam about 3 inches thick. The next 9 inches is light brownish gray, calcareous silt loam. The substratum to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Permeability is moderate in the Colby soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

These soils are used mainly for nonirrigated and irrigated crops or as native rangeland.

Wheat and millet are the dominant nonirrigated crops. Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Stubble-mulch tillage and terraces are needed.

Corn is the dominant irrigated crop. A smaller acreage is used for wheat, sugar beets, and alfalfa. Because of the uneven terrain, circular sprinkler systems are the most effective methods of irrigation.

The potential plant community on the Satanta soil is mainly western wheatgrass, blue grama, needleandthread, and green needlegrass. The average annual production of air-dry vegetation is about 500 to 1,650 pounds per acre.

The potential plant community on the Colby soil is mainly blue grama, western wheatgrass, sideoats grama, and green needlegrass. The average annual production of air-dry vegetation ranges from 600 to 1,600 pounds per acre.

These soils are suited to windbreaks and environmental plantings. Trees can be planted in diversion channels, where additional moisture is available. Also, irrigation water can be applied. Drip irrigation systems work effectively. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are lilac, Siberian peashrub, and American plum.

These soils are well suited to homesite development and other kinds of urban development. Properly designing foundations and roads helps to overcome moderately low soil strength. Measures that prevent excessive erosion are needed during construction. The limitations affecting urban development generally can be overcome easily.

The land capability subclass is IIIe, irrigated, and IVe, nonirrigated. The range site is Loamy Plains.

40—Schamber-Stoneham complex, 6 to 35 percent slopes. These deep soils are on hills, on the edges of benches, and on old high terraces. The native vegetation is mainly mid and short grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 40 percent Schamber very gravelly sandy loam and 40 percent Stoneham loam.

Included in this unit are small areas of Vona loamy sand, Eckley gravelly sandy loam, and Yoder sandy loam. Included soils make up about 20 percent of the total acreage.

The Schamber soil is excessively drained. It formed in sand and gravel derived dominantly from the Ogallala Formation. Slope is 6 to 35 percent. Typically, the surface layer is grayish brown very gravelly sandy loam 3 inches thick. The subsurface layer is brown very gravelly sandy loam 7 inches thick. The upper 8 inches of the substratum is pinkish gray very gravelly loamy sand. The lower part to a depth of 60 inches or more is light gray very gravelly sand.

Permeability is rapid or very rapid in the Schamber soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Stoneham soil is well drained. It formed in calcareous loess and alluvium derived dominantly from mixed sources. Slope is 6 to 25 percent. Typically, the surface layer is yellowish brown loam 3 inches thick. The upper 4 inches of the subsoil is yellowish brown clay loam. The lower 7 inches is very pale brown, calcareous loam. The upper 32 inches of the substratum also is very pale brown, calcareous loam. The lower part to a depth of 60 inches is pink, calcareous sandy clay loam.

Permeability is moderate in the Stoneham soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the

hazard of water erosion is high. The hazard of soil blowing also is high.

These soils are used mainly as native rangeland or as wildlife habitat. They also are used as sources of gravel and roadfill.

The potential plant community on the Schamber soil is mainly blue grama, little bluestem, sideoats grama, and needleandthread. The average annual production of air-dry vegetation ranges from 400 to 1,200 pounds per acre.

The potential plant community on the Stoneham soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 450 to 1,300 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained.

The suitability of these soils for range seeding is poor. The main limitations are the slope and droughtiness. Properly managing livestock grazing helps to prevent excessive erosion.

These soils are poorly suited to windbreaks and environmental plantings. The main limitations are the slope and droughtiness.

These soils are poorly suited to homesite development. The main limitations are the slope and the hazard of erosion.

The land capability subclass is VIIe, nonirrigated. The Schamber soil is in the Gravel Breaks range site, and the Stoneham soil is in the Loamy Slopes range site.

41—Stoneham loam, 0 to 3 percent slopes. This deep, well drained soil is on ridges, hills, and valley side slopes. It formed in mixed calcareous material. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is yellowish brown loam about 3 inches thick. The upper 4 inches of the subsoil is yellowish brown clay loam. The lower 7 inches is very pale brown, calcareous loam. The upper 32 inches of the substratum also is very pale brown, calcareous loam. The lower part to a depth of 60 inches or more is pink, calcareous sandy clay loam.

Included in this unit are small areas of Wiley silt loam, Fort Collins loam, and Satanta loam. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Stoneham soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as native rangeland. Some areas are used as nonirrigated cropland. The soil is best suited to native rangeland but can be cropped successfully if a good ground cover is maintained.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

Range seeding is a suitable practice if the range is in poor condition. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If this soil is used for nonirrigated crops, the main limitations are the thin surface layer and the moderate hazard of soil blowing. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures can help to maintain fertility and tilth. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

This soil is well suited to light construction, septic tank absorption fields, surfaced roads, and recreational uses.

The land capability subclass is IVe, nonirrigated. The range site is Loamy Plains.

42—Stoneham loam, 3 to 6 percent slopes. This deep, well drained soil is on the edges of benches and on ridges and valley side slopes. It formed in mixed calcareous material. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is yellowish brown loam about 3 inches thick. The upper 4 inches of the subsoil is yellowish brown clay loam. The lower 7 inches is very pale brown, calcareous loam. The upper 32 inches of the substratum also is very pale brown, calcareous loam. The lower part to a depth of 60 inches or more is pink, calcareous sandy clay loam.

Included in this unit are small areas of Wiley silt loam, Fort Collins loam, and Satanta loam. Included

areas make up about 20 percent of the total acreage.

Permeability is moderate in the Stoneham soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

This soil is used mainly as native rangeland. Some areas are farmed along with other soils. These areas require intensive management to control erosion. Stubble-mulch tillage, stripcropping, and terraces are effective in controlling erosion.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation is 500 to 1,600 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

If the range has seriously deteriorated, seeding is necessary. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This soil is well suited to homesite development. The main limitations are the slope and the hazard of erosion.

The land capability subclass is IVe, nonirrigated. The range site is Loamy Plains.

43—Stoneham-Kim loams, 6 to 12 percent slopes. These deep, well drained soils are on valley sides, ridges, and hills. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 13 to 17 inches.

This unit is 50 percent Stoneham loam and 25 percent Kim loam.

Included in this unit are small areas of Vona, Olney, and Fort Collins soils. Included areas make up about 25 percent of the total acreage.

The Stoneham soil formed in calcareous material derived dominantly from loess and mixed alluvium. Typically, the surface layer is yellowish brown loam 3 inches thick. The upper 4 inches of the subsoil is yellowish brown clay loam. The lower 7 inches is very pale brown, calcareous loam. The upper 32 inches of the substratum also is very pale brown, calcareous loam. The lower part to a depth of 60 inches is pink, calcareous sandy clay loam.

The Kim soil formed in calcareous material derived dominantly from loess and mixed alluvium. Typically, the surface layer is grayish brown and light brownish gray, calcareous loam 7 inches thick. The upper 23 inches of the substratum is very pale brown, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, calcareous sandy clay loam.

Permeability is moderate in both soils. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

These soils are used mainly as native rangeland. They also are used as nonirrigated cropland along with soils that are better suited to crops.

The potential plant community on the Stoneham soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 450 to 1,300 pounds per acre.

The potential plant community on the Kim soil is mainly blue grama, western wheatgrass, and needleandthread. The average annual production of air-dry vegetation ranges from 450 to 1,200 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Measures that prevent excessive erosion are needed. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate. These measures are especially effective if the range is in poor or fair condition.

The suitability for range seeding is poor. The main limitations are the slope and the hazard of erosion. Disturbed areas should be seeded to grass as soon as possible. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

These soils are poorly suited to nonirrigated crops. The main limitations are the slope and the hazard of erosion. Disturbed areas should be seeded to grass as soon as possible. Planting in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture.

These soils are poorly suited to windbreaks and environmental plantings and to homesite development. The main limitations are the slope and the hazard of erosion.

The land capability subclass is VIe, nonirrigated. The range site is Loamy Slopes.

44—Stoneham-Razor complex, 2 to 6 percent slopes. These well drained soils are on ridges and valley side slopes. Areas are long and irregular in shape and are 20 to 160 acres in size. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 45 percent Stoneham loam and 30 percent Razor clay loam. The Stoneham soil is on the tops and upper parts of the slopes, and the Razor soil is on the lower parts.

Included in this unit are areas of Kim loam and small areas of Fort Collins loam, Vona loamy sand, and Midway clay loam. Included areas make up about 25 percent of the total acreage.

The Stoneham soil is deep. It formed in calcareous loess and mixed alluvium. Typically, the surface layer is yellowish brown loam 3 inches thick. The upper 4 inches of the subsoil is yellowish brown clay loam. The lower 7 inches is very pale brown, calcareous loam. The upper 32 inches of the substratum also is very pale brown, calcareous loam. The lower part to a depth of 60 inches is pink, calcareous sandy clay loam.

Permeability is moderate in the Stoneham soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

The Razor soil is moderately deep. It formed in clayey residuum derived dominantly from soft shale. Typically, the surface layer is grayish brown clay loam 2 inches thick. The subsoil is 13 inches of pale brown clay loam and clay. The substratum is light brownish gray, calcareous clay 15 inches thick. It is underlain by soft shale.

Permeability is slow in the Razor soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

These soils are used mainly as native rangeland or as wildlife habitat. A few areas are used as nonirrigated cropland.

The potential plant community on the Stoneham soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre.

The potential plant community on the Razor soil is mainly western wheatgrass, blue grama, and green needlegrass. The average annual production of air-dry vegetation ranges from 550 to 1,300 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Contour furrowing, ripping, and pitting help to control runoff and increase the water intake rate. These measures are especially effective if the range is in poor or fair condition.

The suitability of these soils for range seeding is moderate. The main limitations are the slow permeability of the Razor soil and the hazard of erosion on both soils. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If these soils are used as nonirrigated cropland, the main limitations are droughtiness, a low water intake rate, shallow topsoil on knobs, the slope, and the hazard of erosion. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow.

Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind. Early fall seeding, stubble-mulch tillage, terraces, diversions, and grassed waterways help to control erosion.

These soils are moderately well suited to windbreaks and environmental plantings. The main limitations are a moderate depth to bedrock, the content of clay, a low water intake rate, a restricted rooting depth, and moderate salinity. Irrigation may be needed when seedlings are planted and during dry periods. Planting on the contour conserves moisture. Among the trees that are suitable for planting are Siberian elm, Russian olive, and eastern redcedar. Among the shrubs are lilac, American plum, and skunkbush sumac.

These soils are moderately well suited to homesite development. The main limitations are soil depth, the potential for shrinking and swelling, restricted permeability, and the hazard of erosion. Onsite investigation is needed to determine the site that is best suited to buildings and septic tank absorption fields.

The hazard of erosion is increased if the surface is exposed. Revegetating disturbed areas as soon as possible helps to control soil blowing. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

A good plant cover can be established and maintained by properly applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for lawns, shrubs,

Figure 3.—Grain sorghum in an area of Sundance loamy sand, 0 to 3 percent slopes, south of Kit Carson.

vines, shade trees, and ornamental trees.

The land capability subclass is IVe, nonirrigated. The Stoneham soil is in the Loamy Plains range site, and the Razor soil is in the Clayey Plains range site.

45—Sundance loamy sand, 0 to 3 percent slopes. This deep, well drained soil is on flats that have poorly defined drainageways. It formed in sandy eolian material over loess derived dominantly from sedimentary rock. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is yellowish brown loamy sand 8 inches thick. The subsoil is brown sandy clay loam about 8 inches thick. Below this is a buried subsoil. The upper 14 inches of the buried subsoil is dark brown clay loam, and the lower 20 inches is pale brown, calcareous silty clay loam. The substratum to a depth of 60 inches is pale brown, calcareous silt loam.

Included in this unit are small areas of Olney, Vona, and Bijou soils. Included areas make up about 30 percent of the total acreage.

Permeability is moderately slow in the Sundance soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This soil is used mainly as rangeland. It also is used as nonirrigated cropland (fig. 3).

The potential plant community on this soil is mainly prairie sandreed, blue grama, little bluestem, and sideoats grama. The average annual production of air-dry vegetation ranges from 800 to 1,800 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Measures that prevent excessive soil blowing are needed. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

The suitability of this soil for range seeding is moderate. The main limitations are droughtiness and the hazard of soil blowing. Seeding in the stubble of the

preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If this soil is used as nonirrigated cropland, the main limitations are the hazard of soil blowing and droughtiness in the surface layer. The soil is suited to annual cropping of grain sorghum. The stubble is left standing, and the new crop is seeded between the rows of stubble. This practice protects the surface from soil blowing. The sandy surface layer retards evaporation, thus conserving moisture stored in the subsoil. Leaving crop residue on or near the surface conserves moisture and helps to maintain tilth and control erosion. Crops respond well to nitrogen and phosphorus fertilizer. Tillage should be minimized.

This soil is moderately well suited to windbreaks and environmental plantings. Soil blowing is a hazard before the trees and shrubs become established. It can be controlled by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Irrigation may be needed when seedlings are planted and during dry periods. Among the trees that are suitable for planting are Russian olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Among the shrubs are Siberian peashrub, sand cherry, and lilac.

This soil is well suited to homesite development. The main limitations are a moderate ability of the soil to support a load and the hazard of soil blowing. Preserving the existing plant cover during construction and revegetating disturbed areas as soon as possible help to control soil blowing. In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The design of buildings and roads should offset the limited ability of the soil to support a load. Cutbanks are not stable and are subject to caving.

The land capability subclass is IVe, nonirrigated. The range site is Sandy Plains.

46—Ulm loamy sand, 0 to 3 percent slopes. This deep, well drained soil is on valley side slopes and bottoms. It formed in sandy material over moderately fine textured alluvium derived dominantly from sedimentary rock. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is brown loamy sand 10 inches thick. The upper 15 inches of the subsoil is brown clay loam. The lower 21 inches is brown and pale brown, calcareous clay and clay loam. The substratum to a depth of 60 inches is very pale brown, calcareous sandy clay loam.

Included in this unit are small areas of Ulm loam, Manzanola clay loam, and Olney sandy loam. Included areas make up about 30 percent of the total acreage.

Permeability is slow in the Ulm soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This soil is used as native rangeland. The potential plant community is mainly prairie sandreed, blue grama, sideoats grama, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,500 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

Properly managing livestock grazing helps to prevent excessive soil blowing. If the range has seriously deteriorated, seeding is necessary. The main limitations affecting range seeding are the hazard of soil blowing and the droughty surface layer. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Interseeding is suitable in areas where seedbed preparation is not practical. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This soil is moderately well suited to windbreaks and environmental plantings. The main limitations are the hazard of soil blowing and the content of clay in the subsoil. Cultivating only in the tree rows and leaving a strip of vegetation between the rows can reduce the hazard of soil blowing. Irrigation is needed when the seedlings are planted and during dry periods. Among the trees that are suitable for planting are eastern redcedar, Russian olive, and Siberian elm. Among the shrubs are lilac, sand cherry, and American plum.

Septic tank absorption fields do not function properly because of the slow permeability of this soil. The absorption lines should be installed below the slowly permeable layer. Increasing the size of the absorption area, backfilling the trench with sandy material, and installing long absorption lines can help to compensate for the restricted permeability.

Selection of adapted plants is critical in areas used for lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

Properly designing buildings and roads can offset the limited ability of the soil to support a load. Using proper engineering designs and backfilling with material that has a low shrink-swell potential can minimize the effects of shrinking and swelling.

The land capability subclass is IVe, nonirrigated. The range site is Sandy Plains.

47—Ulm loam, 0 to 3 percent slopes. This deep, well drained soil is on valley side slopes and bottoms. It formed in moderately fine textured alluvium derived dominantly from sedimentary rock. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is brown loam 3 inches thick. The upper 16 inches of the subsoil is brown clay loam. The lower 11 inches is brown and pale brown, calcareous clay and clay loam. The substratum to a depth of 60 inches is very pale brown, calcareous loam.

Included in this unit are small areas of Manzanola clay loam, Nunn clay loam, and Fort Collins loam. Included areas make up about 35 percent of the total acreage.

Permeability is slow in the Ulm soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used as native rangeland or as nonirrigated cropland.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Range seeding is a suitable practice if the range is in poor condition. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices. Chiseling and pitting increase the rate of water infiltration. These measures are especially effective if the range is in poor condition.

This soil is well suited to nonirrigated crops. It has few limitations. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by keeping the surface rough and cloddy when it is not protected by vegetation and by planting crops in alternate strips at right angles to the prevailing wind.

This soil is well suited to windbreaks and environmental plantings. Irrigation may be needed when seedlings are planted and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Russian olive, hackberry, ponderosa pine, and eastern redcedar. Among the shrubs are Siberian peashrub, skunkbush sumac, multiflora rose, and lilac.

If this soil is used for homesite development, the main limitations are a low load-bearing capacity, a high shrink-swell potential, and the slow permeability. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields do not function properly because of the slow permeability. The absorption lines should be installed below the slowly permeable layer. Increasing the size of the absorption area, backfilling the trench with sandy material, and installing long absorption lines can help to compensate for the restricted permeability.

Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Revegetating disturbed areas as soon as possible helps to control soil blowing. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The land capability subclass is IVe, nonirrigated. The range site is Loamy Plains.

48—Valent loamy sand, 3 to 12 percent slopes. This deep, excessively drained soil is on sandhills and ridges. It formed in sandy eolian material derived dominantly from sedimentary rock. The native vegetation is mainly grasses and sagebrush. The average annual precipitation is about 13 to 17 inches.

Typically, the surface layer is yellowish brown loamy sand about 16 inches thick. The substratum to a depth of 60 inches is light yellowish brown sand.

Included in this unit are Bijou loamy sand, Vona loamy sand, and Olney sandy loam. Included soils

make up about 20 percent of the total acreage.

Permeability is rapid in the Valent soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This soil is used mainly as native rangeland or as wildlife habitat. The potential plant community is mainly prairie sandreed, sand bluestem, switchgrass, and blue grama. The average annual production of air-dry vegetation is about 1,200 to 2,500 pounds per acre.

The suitability of this soil for range seeding is poor. The main limitations are droughtiness and the hazard of soil blowing. Ground cover is essential, and additional moisture, if available, is beneficial. Mulching with manure or grass hay and interseeding are common practices. Proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control are suitable management practices. This soil is limited as a site for livestock watering ponds and other water impoundments because of the hazard of seepage.

If this soil is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and droughtiness. The hazard of soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Planting in shallow furrows increases the amount of available moisture. Irrigation is needed when trees are planted and during dry periods. Among the trees that are suitable for planting are Siberian elm, Russian olive, eastern redcedar, and ponderosa pine. Among the shrubs are skunkbush sumac, lilac, and sand cherry.

This soil is suited to light construction. Cutbanks are not stable and are subject to caving. The hazard of soil blowing is increased if the surface is exposed during site development. This hazard can be reduced by revegetating disturbed areas as soon as possible. Selection of adapted vegetation is critical in areas used for lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

Septic tanks and drainage fields should not be located near water sources. Water contamination is possible because of the rapid permeability of this soil. If the density of housing is moderate to high, community sewage systems are needed to prevent the contamination of water supplies caused by seepage from onsite sewage disposal systems.

The land capability subclass is VIe, nonirrigated. The range site is Deep Sand.

49—Valent-Vona-Bijou loamy sands, 4 to 12 percent slopes. These deep soils are on hills and ridges. The native vegetation is mainly mid and tall grasses and sagebrush. The average annual precipitation is about 13 to 15 inches.

This unit is 35 percent Valent loamy sand, 20 percent Vona loamy sand, and 20 percent Bijou loamy sand.

Included in this unit are areas of Ulm loamy sand and Olney sandy loam, which make up about 25 percent of the total acreage.

The Valent soil is excessively drained. It formed in sandy eolian material. Typically, the surface layer is yellowish brown loamy sand 16 inches thick. The substratum to a depth of 60 inches is light yellowish brown sand.

Permeability is rapid in the Valent soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

The Vona soil is somewhat excessively drained. It formed in mixed sandy eolian material and calcareous loess. Typically, the surface layer is grayish brown loamy sand 4 inches thick. The subsoil is brown and pale brown sandy loam 16 inches thick. The substratum to a depth of 60 inches or more is pale brown, calcareous loamy sand.

Permeability is moderately rapid in the Vona soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Bijou soil is somewhat excessively drained. It formed in mixed eolian and alluvial material derived from many sources. Typically, the surface layer is grayish brown loamy sand about 5 inches thick. The upper 8 inches of the subsoil is brown sandy loam. The lower 5 inches is yellowish brown loamy sand. The substratum to a depth of 60 inches is brown sand.

Permeability is moderately rapid in the Bijou soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

These soils are used as native rangeland or as wildlife habitat.

The potential plant community on the Valent soil is mainly prairie sandreed, sand bluestem, switchgrass, blue grama, and needlegrass. The average annual production of air-dry vegetation ranges from 1,200 to 2,500 pounds per acre.

The potential plant community on the Vona soil is mainly prairie sandreed, blue grama, little bluestem, and sideoats grama. The average annual production of air-dry vegetation ranges from 900 to 2,200 pounds per acre.

The potential plant community on the Bijou soil is mainly prairie sandreed, blue grama, and sand bluestem. The average annual production of air-dry

vegetation ranges from 800 to 2,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained.

The suitability of these soils for range seeding is poor. The main limitations are droughtiness and the hazard of soil blowing. Ground cover should be maintained. Interseeding is the best reseeding method. Small areas can be reseeded by establishing a cover crop, mowing it, and then seeding grass into the stubble. Deferred grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

These soils are poorly suited to windbreaks and environmental plantings. The main limitations are droughtiness and the hazard of soil blowing. This hazard can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Irrigation is needed when trees are planted and during dry periods. Among the trees that are suitable for planting are Siberian elm, Russian olive, and juniper. Among the shrubs are American plum, lilac, and sand cherry.

These soils are moderately well suited to homesite development. The main limitations are the slope, the hazard of erosion, and the instability of cutbanks. In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating disturbed areas as soon as possible helps to control soil blowing.

A good plant cover can be established and maintained by properly applying fertilizer and by seeding, mulching, and land shaping. In summer, irrigation is needed in areas used for lawns, shrubs, vines, shade trees, and ornamental trees.

If the density of housing is moderate to high, community sewage systems are needed to prevent the contamination of water supplies caused by seepage from onsite sewage disposal systems. The slope is a management concern on sites for septic tank absorption fields. The absorption lines should be installed on the contour.

The land capability subclass is VIe, nonirrigated. The Vona and Bijou soils are in the Sandy Plains range site, and the Valent soil is in the Deep Sand range site.

50—Vona loamy sand, 0 to 3 percent slopes, eroded. This deep, somewhat excessively drained soil is on uplands. It formed in calcareous eolian material. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is grayish brown loamy sand about 4 inches thick. The upper 6 inches of the subsoil is brown sandy loam. The lower 10 inches is pale brown, calcareous sandy loam. The substratum to a depth of 60 inches or more is pale brown, calcareous loamy sand.

Included in this unit is Olney sandy loam, which makes up about 15 percent of the total acreage.

Permeability is moderately rapid in the Vona soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This soil is used mainly as rangeland. Many areas that formerly were cultivated have been seeded to grass or have revegetated naturally to grass and weeds. A few areas are used as nonirrigated cropland.

Cultivated areas commonly are severely eroded. The highly calcareous subsoil or substratum is at the surface in the severely eroded areas. Natural fertility is low. A high content of lime decreases the available supply of most plant nutrients. Chlorosis is apparent, particularly in sorghum. Where erosion is severe, the surface layer is noticeably lighter in color, especially on ridges.

Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Contour farming and stubble-mulch tillage conserve moisture and help to control erosion and runoff. Wind stripcropping and contour stripcropping are effective in controlling soil blowing. Tillage should be minimized. Intensive management is needed because of the hazard of soil blowing.

The potential plant community on this soil is mainly prairie sandreed, blue grama, little bluestem, and sideoats grama. Other plants that characterize this site are sand bluestem, sand dropseed, switchgrass, and sand sagebrush. The average annual production of air-dry vegetation is about 900 to 2,200 pounds per acre.

This soil generally is suited to windbreaks and environmental plantings. Additional moisture is needed, however, for long-term survival. Seedlings can be planted in diversion channels, where additional moisture is available. Also, irrigation water can be applied. Drip irrigation systems work effectively. Soil blowing is the main hazard before the trees and shrubs are established. This hazard can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to homesite development and other kinds of urban development if soil blowing is

controlled. The limitations affecting urban uses can be easily overcome. Sealing sewage lagoons helps to prevent seepage.

The land capability subclass is IVe, nonirrigated. The range site is Sandy Plains.

51—Vona loamy sand, 3 to 6 percent slopes. This deep, somewhat excessively drained soil is on side slopes, ridges, and hills. It formed in calcareous eolian material. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

Typically, the surface layer is grayish brown loamy sand about 4 inches thick. The upper 6 inches of the subsoil is brown sandy loam. The lower 10 inches is pale brown, calcareous sandy loam. The substratum to a depth of 60 inches or more is pale brown, calcareous loamy sand.

Included in this unit are areas of Olney sandy loam and Valent loamy sand, which make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Vona soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This unit is used mainly for grazing. It is not well suited to nonirrigated crops because of the moderate available water capacity, limited precipitation, and the hazard of soil blowing. Areas of nonirrigated cropland should be seeded back to grass.

The potential plant community on this soil is mainly blue grama, sideoats grama, and sand dropseed. Other plants that characterize this site are little bluestem, prairie sandreed, and thickspike wheatgrass. The average annual production of air-dry vegetation is about 600 to 1,500 pounds per acre.

This soil generally is suited to windbreaks and environmental plantings. Additional moisture is needed, however, for long-term survival. The trees can be planted in diversion channels, where additional moisture is available. Also, irrigation water can be applied. Drip irrigation systems work effectively. Soil blowing is the main hazard before the trees and shrubs are established. This hazard can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to homesite development and other kinds of urban development if soil blowing is controlled. The limitations that affect urban uses can be easily overcome. Sealing sewage lagoons helps to prevent seepage.

The land capability subclass is VIe, nonirrigated. The range site is Sandy Plains.

52—Vona-Olney complex, 3 to 12 percent slopes. These deep soils are on hills and ridges. The native vegetation is mainly short grass. The average annual precipitation is about 13 to 15 inches.

This unit is 50 percent Vona loamy sand and 30 percent Olney sandy loam.

Included in this unit are small areas of Manter loamy sand, Valent loamy sand, and Otero sandy loam. Included areas make up about 20 percent of the total acreage.

The Vona soil is somewhat excessively drained. It formed in mixed calcareous, sandy eolian material and loess. Typically, the surface layer is grayish brown loamy sand 4 inches thick. The subsoil is brown and pale brown sandy loam 16 inches thick. The substratum to a depth of 60 inches or more is pale brown, calcareous loamy sand.

Permeability is moderately rapid in the Vona soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Olney soil is well drained. It formed in mixed calcareous loess and sandy material derived dominantly from eolian and alluvial deposits. Typically, the surface layer is brown sandy loam 4 inches thick. The upper 14 inches of the subsoil is yellowish brown and light yellowish brown sandy clay loam. The lower 5 inches is very pale brown sandy loam. The substratum to a depth of 60 inches or more is pale brown, calcareous sandy loam.

Permeability is moderate in the Olney soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

These soils are used as native rangeland or as wildlife habitat.

The potential plant community on the Vona soil is mainly prairie sandreed, blue grama, little bluestem, and sideoats grama. The average annual production of air-dry vegetation ranges from 900 to 2,200 pounds per acre.

The potential plant community on the Olney soil is mainly blue grama, prairie sandreed, sideoats grama, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. The suitability for range seeding is poor, mainly because of the hazard of erosion.

These soils are poorly suited to windbreaks and environmental plantings and to homesite development. The main limitations are the slope and the hazard of erosion.

The land capability subclass is VIe, nonirrigated. The range site is Sandy Plains.

53—Weld silt loam, 0 to 1 percent slopes. This deep, well drained soil is on broad upland flats. It formed in calcareous, silty loess. The native vegetation is mainly grasses. The average annual precipitation is 15 to 17 inches.

Typically, the surface layer is brown silt loam about 3 inches thick. The upper 12 inches of the subsoil is grayish brown and brown silty clay. The lower 6 inches is brown, calcareous silty clay. The upper 10 inches of the substratum is light gray, calcareous silt loam. The lower part to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Included in this unit are areas of Keith silt loam, which makes up about 15 percent of the total acreage.

Permeability is slow in the Weld soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as rangeland or as nonirrigated or irrigated cropland. Wheat and millet are the dominant nonirrigated crops. The supply of moisture is insufficient for annual cropping without irrigation.

Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Stubble-mulch tillage and stripcropping are needed. Subsurface tillage equipment, such as chisels, sweeps, and rod weeders, can be effective in maintaining crop residue on the surface. Chemical weed control can complement a stubble-mulch program and minimize tillage. Chiseling or subsoiling can improve water infiltration.

Border and furrow systems generally are used in the irrigated areas. Circular sprinkler systems also are used effectively. Corn is the dominant irrigated crop. A smaller acreage is used for wheat, sugar beets, alfalfa, or pinto beans. The management needs in irrigated areas include the proper use of irrigation water and measures that maintain fertility, minimize disease, and control insects. Crop rotation systems help to maintain fertility. Crops commonly respond well to heavy applications of nitrogen and moderate applications of phosphorus.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation is about 600 to 1,700 pounds per acre.

This soil is suited to windbreaks and environmental plantings. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, and continued cultivation for weed control can help to ensure that seedlings become established and survive. Trees can be planted in diversion channels, where additional moisture is available. Also, irrigation water can be applied. Drip irrigation systems work effectively. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this soil is used for homesite development, the main limitations are a high shrink-swell potential and the slow permeability. These limitations can be overcome by proper engineering designs and practices, by backfilling with desirable material, and by installing leach lines and foundations below the subsoil.

The land capability subclass is IIe, irrigated, and IIIe, nonirrigated. The range site is Loamy Plains.

54—Wiley complex, 0 to 3 percent slopes, eroded. This deep, well drained soil is on upland ridges, hills, and side slopes. It formed in calcareous loess. The native vegetation is mainly grasses. The average annual precipitation is 13 to 16 inches.

Typically, the surface layer is brown silt loam about 3 inches thick. The upper 12 inches of the subsoil is pale brown, calcareous silty clay loam. The lower 8 inches is very pale brown, calcareous silt loam. The substratum to a depth of 60 inches or more also is very pale brown, calcareous silt loam.

Included in this unit are areas of Colby silt loam, Baca silt loam, and Stoneham loam. Included soils make up about 20 percent of the total acreage.

Permeability is moderate in the Wiley soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used as rangeland or as nonirrigated or irrigated cropland. Wheat and millet are the dominant nonirrigated crops. The supply of moisture is insufficient for annual cropping without irrigation.

Cultivated areas commonly are severely eroded. In these severely eroded areas, the highly calcareous

subsoil or substratum of silty clay loam or silt loam is at the surface. A high content of lime decreases the available supply of many plant nutrients. Chlorosis is apparent, particularly in sorghum. Where erosion is severe, the surface is noticeably lighter colored, especially on ridges.

Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Stubble-mulch tillage and stripcropping conserve both soil and moisture. Subsurface tillage equipment, such as chisels, sweeps, and rod weeders, can be effective in maintaining crop residue on the surface. Terraces are helpful in controlling runoff. Where flat-channel terraces are used, applications of fertilizer that contains nitrogen and phosphorus are needed in the channels.

Border and furrow systems generally are used in the irrigated areas. Circular sprinkler systems also are used effectively. Corn is the dominant irrigated crop. A smaller acreage is used for wheat, sugar beets, alfalfa, or pinto beans. The management needs in irrigated areas include the proper use of irrigation water and measures that maintain fertility, control erosion, minimize disease, and control insects. Crop rotation systems help to maintain fertility.

Crops usually respond well to heavy applications of nitrogen and moderate applications of phosphorus. Applications of iron and zinc also may be needed. Irrigation late in fall allows the soil to store moisture throughout the profile. It is especially effective where sprinklers are used.

The potential plant community on this soil is blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation is about 600 to 1,600 pounds per acre.

Establishing windbreaks and environmental plantings is difficult on this soil because of the limited moisture supply. Summer fallow, supplemental watering when seedlings are planted and during early stages of growth, and continued cultivation for weed control can help to ensure that seedlings become established and survive. Additional moisture can be added through irrigation, or the trees can be planted in diversion channels, where extra moisture is available. Drip irrigation systems work efficiently. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is moderately well suited to homesite development and other kinds of urban development. The main limitations are low soil strength and the moderate hazard of soil blowing. These limitations can be overcome by proper engineering designs and practices.

The land capability subclass is IIe, irrigated, and IVe, nonirrigated. The range site is Loamy Plains.

55—Wiley complex, 3 to 5 percent slopes, eroded. This deep, well drained soil is on ridges, hills, and valley side slopes. It formed in calcareous, silty eolian material. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 16 inches.

Typically, the surface layer is brown silt loam about 3 inches thick. The upper 12 inches of the subsoil is pale brown, calcareous silty clay loam. The lower 8 inches is very pale brown, calcareous silt loam. The substratum to a depth of 60 inches or more also is very pale brown, calcareous silt loam.

Included in this unit are areas of Colby silt loam, Ulysses and Keith silt loam, and Stoneham loam. Included soils make up about 20 percent of the total acreage.

Permeability is moderate in the Wiley soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing also is high.

This soil is used as rangeland and as nonirrigated cropland. Wheat and millet are the dominant nonirrigated crops.

The potential plant community on this soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation is about 600 to 1,600 pounds per acre.

Cultivated areas commonly are severely eroded. In these severely eroded areas, the highly calcareous subsoil or substratum of silty clay loam or silt loam is at the surface. A high content of lime decreases the available supply of many plant nutrients. Chlorosis is apparent, particularly in sorghum. Where erosion is severe, the surface is noticeably lighter colored, especially on ridges.

Control of soil blowing and conservation of moisture are important concerns in areas of nonirrigated cropland. Terraces, contour farming, stripcropping, and stubble-mulch tillage are effective management measures.

Unless intensive management is applied, establishing windbreaks and environmental plantings is difficult on this soil because of the scarcity of moisture. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is moderately well suited to homesite

development and other kinds of urban development. The main limitations are low soil strength and the hazard of erosion. These limitations can be overcome by proper engineering designs and practices.

The land capability subclass is IVe, nonirrigated. The range site is Loamy Plains.

56—Yoder-Stoneham complex, 0 to 6 percent slopes. These deep soils are on terraces and side slopes. The native vegetation is mainly short and mid grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 40 percent Yoder sandy loam and 30 percent Stoneham loam.

Included in this unit are areas of Olney sandy loam, Vona loamy sand, and Ascalon sandy loam. Included soils make up about 30 percent of the total acreage.

The Yoder soil is somewhat excessively drained. It formed in loamy material over sand and gravel derived dominantly from mixed sources. Typically, the surface layer is yellowish brown sandy loam 4 inches thick. The subsoil is dark yellowish brown sandy clay loam 10 inches thick. The upper 3 inches of the substratum is brownish yellow gravelly sandy loam. The lower part to a depth of 60 inches is brownish yellow gravelly loamy sand.

Permeability is moderately rapid in the Yoder soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Stoneham soil is well drained. It formed in calcareous loess and alluvium derived dominantly from mixed sources. Typically, the surface layer is yellowish brown loam 3 inches thick. The upper 4 inches of the subsoil is yellowish brown clay loam. The lower 2 inches is very pale brown, calcareous loam. The upper 37 inches of the substratum also is very pale brown, calcareous loam. The lower part to a depth of 60 inches is pink, calcareous sandy clay loam.

Permeability is moderate in the Stoneham soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

These soils are used mainly as native rangeland or as wildlife habitat. A few areas are used as nonirrigated cropland.

The potential plant community on the Yoder soil is mainly blue grama, prairie sandreed, and sideoats grama. The average annual production of air-dry vegetation ranges from 700 to 2,000 pounds per acre.

The potential plant community on the Stoneham soil is mainly blue grama, western wheatgrass, and green needlegrass. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. Range seeding is a suitable practice if the range is in poor condition. The range responds well to applications of fertilizer, range seeding, and proper grazing use. Seeding in the stubble of the preceding crop preserves the ground cover. The stubble helps to trap snow, which provides additional moisture. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

If these soils are used for nonirrigated crops, the main limitations are droughtiness and the hazard of erosion. The best suited crops are those that are tolerant of drought. Other crops do not grow well because the supply of available moisture is not adequate. Because the amount of precipitation is not sufficient for annual cropping, the best cropping system is one that includes small grain and summer fallow. Planting in furrows or ditches can increase the amount of moisture available to crops.

Maintaining crop residue on or near the surface helps to control runoff and soil blowing and maintains tilth and the organic matter content. Tillage should be minimized. Soil blowing can be controlled by planting crops in alternate strips at right angles to the prevailing wind.

These soils are moderately well suited to windbreaks and environmental plantings. Irrigation is needed when seedlings are planted and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants can help to ensure that seedlings become established and survive. Among the trees that are suitable for planting are Rocky Mountain juniper, Siberian elm, ponderosa pine, and Russian olive. Among the shrubs are lilac, Siberian peashrub, and sand cherry.

These soils are moderately well suited to homesite development. The main limitations are the instability of cutbanks and the hazard of erosion. Cutbanks are subject to caving. Preserving the existing plant cover during construction helps to control erosion. Topsoil can be stockpiled and used to reclaim disturbed areas. In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating disturbed areas as soon as possible helps to control soil blowing. Mulch, applications of fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

If the density of the housing is moderate to high, community sewage systems are needed to prevent the

contamination of water supplies caused by seepage from onsite sewage disposal systems. The effluent from septic tank absorption fields can surface in downslope areas and thus create a health hazard.

The land capability subclass is IVe, nonirrigated. The Yoder soil is in the Sandy Plains range site, and the Stoneham soil is in the Loamy Plains range site.

57—Yoder-Vona complex, 6 to 25 percent slopes. These deep, somewhat excessively drained soils are on side slopes. The native vegetation is mainly grasses. The average annual precipitation is about 13 to 15 inches.

This unit is 45 percent Yoder sandy loam and 30 percent Vona loamy sand.

Included in this unit are areas of Schamber gravelly sandy loam, Stoneham loam, and Razor clay loam. Included soils make up about 25 percent of the total acreage.

The Yoder soil formed in loamy material over sand and gravel derived dominantly from mixed sources. The slope is 6 to 25 percent. Typically, the surface layer is yellowish brown sandy loam 4 inches thick. The upper 10 inches of the subsoil is dark yellowish brown sandy clay loam. The lower 3 inches is brownish yellow gravelly sandy loam. The upper 33 inches of the substratum is brownish yellow gravelly loamy sand. The lower part to a depth of 60 inches is very pale brown, calcareous gravelly sand.

Permeability is moderately rapid in the Yoder soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing also is high.

The Vona soil formed in mixed calcareous loess and sandy material derived dominantly from eolian deposits. The slope is 6 to 12 percent. Typically, the surface layer is grayish brown loamy sand 4 inches thick. The subsoil is brown and pale brown sandy loam 16 inches thick. The substratum to a depth of 60 inches or more is pale brown, calcareous loamy sand.

Permeability is moderately rapid in the Vona soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

These soils are used mainly as native rangeland or as wildlife habitat. They also are used as sources of gravel and roadfill.

The potential plant community on the Yoder soil is mainly blue grama, prairie sandreed, and sideoats grama. The average annual production of air-dry vegetation ranges from 700 to 2,000 pounds per acre.

The potential plant community on the Vona soil is mainly prairie sandreed, blue grama, little bluestem, and sideoats grama. Sagebrush is common. The average annual production of air-dry vegetation ranges from 900 to 2,200 pounds per acre.

If the range is overgrazed, the proportion of the preferred forage plants decreases and the proportion of the less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of the preferred species is maintained. The suitability for range seeding is poor. The main limitations are the slope, droughtiness, and the hazard of erosion. Deferring grazing, rotating grazing, and alternating the season of grazing are suitable management practices.

These soils are poorly suited to windbreaks and environmental plantings. The main limitations are the slope, droughtiness, and the hazard of erosion.

These soils are poorly suited to homesite development. The main limitations are the slope and the hazard of erosion.

The land capability subclass is VIe, nonirrigated. The range site is Sandy Plains.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

About 790,279 acres, or nearly 69 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Carol J. Waugh, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

On the nonirrigated cropland in Cheyenne County, the main crops are wheat, grain sorghum, and barley. Soil blowing and water erosion are major management concerns. Erosion results in the deposition of sediments in streams and reservoirs and in reduced long-term soil productivity.

Measures that minimize soil loss include cropping only those soils that are best suited to cultivation, growing crops that produce large amounts of crop residue, keeping the crop residue on the surface through proper management of tillage and grazing after harvest, and keeping the surface rough through proper tillage during periods when the amount of crop residue is inadequate. A system of conservation tillage not only minimizes soil loss but also cuts production costs and maintains or increases yields.

Applications of nitrogen, phosphorus, and in some areas potassium are necessary for optimum yields. For some crops applications of trace elements, such as zinc and iron, may be necessary.

Terraces conserve water, protect fields against erosion, prevent the loss of soil nutrients, and increase crop production. They are practical on deep soils that have gentle slopes. Terrace systems should be properly designed and should be used in combination with contour farming and crop residue management.

Crops grown on irrigated cropland include corn, wheat, sugar beets, pinto beans, barley, sunflowers, and alfalfa. Periods of irrigation should be scheduled according to the type of crop grown and the kind of soil. Supplemental watering in the fall helps to prevent peak season water shortages. Applying nitrogen fertilizer

after the supplemental water is added helps to prevent leaching of the nitrogen out of the root zone.

Center-pivot irrigation is the prevalent method of water application. Farming areas irrigated by a center-pivot system in a circle helps to keep the wheel tracks from cutting across furrows. It also results in less runoff and more infiltration of water into the soil. Applying a system of conservation tillage and incorporating part of the crop residue into the soil also increases the infiltration rate. An adequate cover of crop residue or cover crops help to control soil blowing.

All crops on irrigated soils respond well to applications of fertilizer. All crops grown on sandy loams irrigated by sprinkler systems require timely and fairly heavy applications of nitrogen. Soil tests are needed to determine the proper rate of fertilizer application.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(10)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture,

rangeland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Rangeland

Ben P. Berlinger, area range conservationist, Soil Conservation Service, helped prepare this section.

Approximately 50 percent of the acreage in Cheyenne County is rangeland. The average farm is about 2,715 acres in size. About half of the farm income is derived from the sale of livestock, principally cattle *(13)*. The cow-calf-yearling enterprise is the dominant type of ranching. The ranches are intermingled with cropland. On many ranches the forage produced on the rangeland is supplemented with wheat pasture. During the winter the range forage is supplemented by a protein supplement.

Soils strongly influence the native vegetation. The eastern half of the survey area has loamy and silty soils that support a potential plant community of blue grama, western wheatgrass, green needlegrass, and buffalograss. Sandy soils support a potential plant community of prairie sandreed, sand bluestem, switchgrass, needleandthread, and sideoats grama. These soils are generally in the southwestern quarter of the county. Annual forage production on sandy soils is slightly higher than that on loamy soils and is substantially higher than that on fine textured soils. In the rest of the county, the soils formed in material weathered from shale. These soils are calcareous and fine textured. They support a potential plant community of alkali sacaton, galleta, western wheatgrass, and blue grama.

Sound range management based on soil survey information and rangeland inventories can increase forage production in the survey area. Proper grazing management is the major management need. The intensity and frequency of grazing should be controlled so that the kinds and amounts of plants that make up the potential plant community are reestablished and maintained. To achieve proper grazing use, about 50 percent, by weight, of the current season's growth of selected key species generally should remain ungrazed at the end of the growing season.

Deferred grazing or the application of a planned grazing system improves the condition of a range site, especially on sandy soils, and enhances wildlife habitat. Deferment is the postponement of grazing during any part or all of the growing season of key forage plants. Rotating deferment among several pastures improves the entire range unit. It allows the forage plants to grow to an adequate height before they are grazed and thus helps them to replenish root food reserves and develop mature seed.

Fencing, developing water areas, and distributing salt blocks help to achieve a more uniform distribution of grazing. Range pitting and chiseling conserve runoff, increase the rate of water intake, help to prevent excessive erosion, and speed recovery of the vegetation (fig. 4). They are most effective on Loamy Plains, Clayey Plains, and Shaly Plains range sites that are in poor or fair condition.

Range seeding may be necessary to improve seriously depleted rangeland. Sandy soils can be seeded by the rangeland interseeder method, which reduces the hazard of erosion. Loamy soils can be seeded most successfully by drilling the grass seed into a preparatory stubble cover of sorghum or sudan. The best time for range seeding in the survey area is the period November to mid-May. Brush control is effective where competing shrubs, such as sand sagebrush, have so significantly increased in extent that they exceed their extent in the potential plant community. Deferment of grazing for 1 or 2 years after brush-control measures are applied allows the desired forage grasses to become established.

Table 7 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In

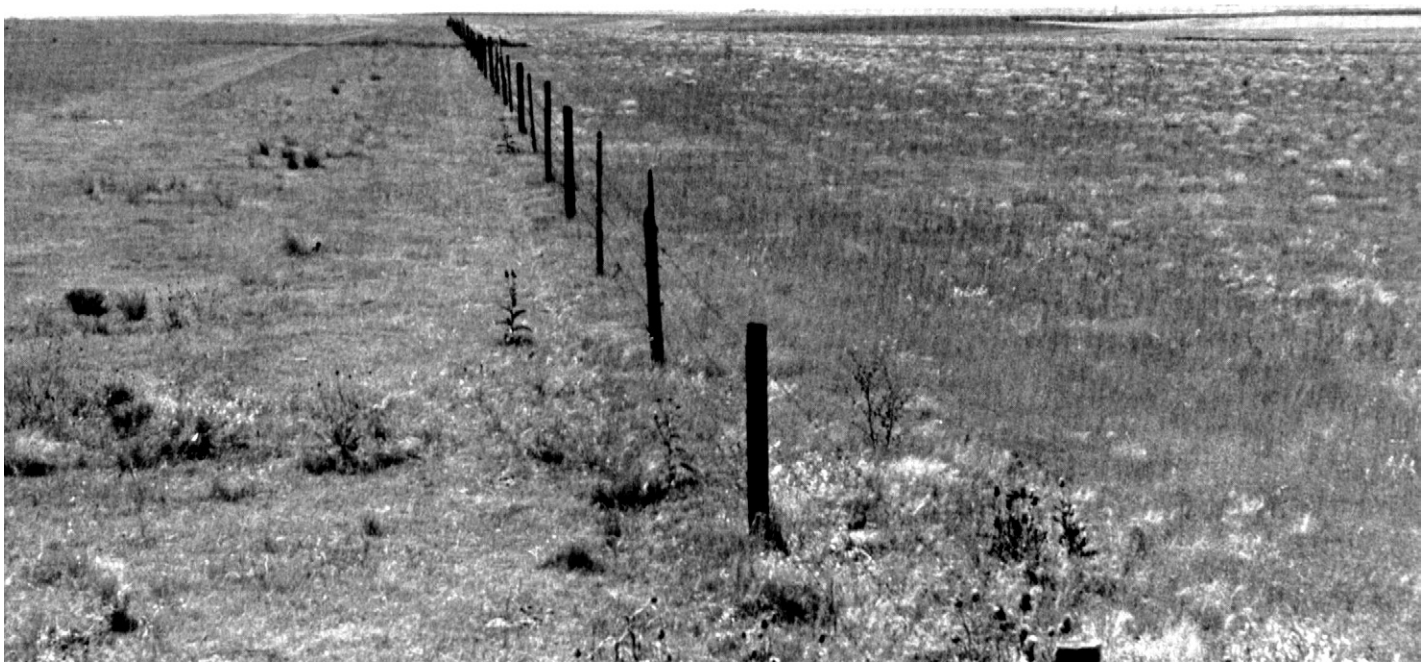

Figure 4.—Range pitting in an area of Keith-Ulysses silt loams, 1 to 4 percent slopes. The pitting on the right increased forage production and reduced the hazard of water erosion by retaining runoff and increasing the rate of water intake.

a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Windbreaks and Environmental Plantings

Edwin W. Olmsted, Jr., woodland conservationist, Soil Conservation Service, helped prepare this section.

Windbreaks and environmental plantings have a variety of uses in Cheyenne County. They protect livestock, buildings, yards, fruit trees, and gardens from wind and snow. As field windbreaks, they can protect cropland and crops from soil blowing. They trap snow and thus increase the moisture supply. Also, they furnish habitat for wildlife, greatly enhance the beauty of the plains, screen buildings, and abate noise.

Generally, several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide adequate protection. Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil.

Establishing windbreaks and environmental plantings is difficult in the dry climate of Cheyenne County. Supplemental moisture is needed to ensure survival. The trees can be planted in diversion channels, where additional moisture is available. Also, irrigation water can be applied. A drip system is the most efficient and effective irrigation method. Selecting a healthy planting stock of a suitable species helps to ensure survival. The site should be prepared before planting and maintained after planting. Other measures needed to ensure the establishment and survival of the trees and shrubs include weed control through continued cultivation, protection from abrasive soil blowing, and control of insects and rodents.

Some of the trees and shrubs that can be grown as

windbreaks and environmental plantings on the soils in the county are specified in the soil descriptions under the heading "Detailed Soil Map Units." Soils that are shallow or are affected by salinity generally are not suited to windbreaks and environmental plantings.

Additional information about planning windbreaks and screens can be obtained from local offices of the Soil Conservation Service or Cooperative Extension Service or from a local nursery.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 10 and interpretations for septic tank absorption fields in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Eldie W. Mustard, biologist, Soil Conservation Service, helped prepare this section.

The species of wildlife in Cheyenne County include those that typically inhabit the plains or rangeland in Colorado. Some of the typical wildlife species are antelope, mule deer, jackrabbit, meadowlark, horned lark, golden eagle, and coyote. The conversion of part of the native prairie into cropland on which grain is grown has provided an ecological niche for the popular ring-necked pheasant. A lack of permanent water areas of any consequence limits the habitat for waterfowl and geese, but the grain fields provide food for the waterfowl and geese on their spring and fall migrations.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat

can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, meadowlark, and lark bunting.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or

for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of

the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a

depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a

cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas *(11)*. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*. Both systems are described in the *PCA Soil Primer (7)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits)

indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very

high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate

(high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(12)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning flood plain, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Torrifluvents (*Torri*, meaning hot and dry, plus *fluvent*, the suborder of the Entisols that are formed as a result of deposition on flood plains).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Ustic* identifies the subgroup that is an intergrade to soils with an ustic moisture regime. An example is Ustic Torrifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, mesic Ustic Torrifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (9)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (12)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Apishapa Family

These are deep, somewhat poorly drained soils in small, closed basins on uplands. The soils formed in clayey alluvium. Slope is 0 to 1 percent. The mean

annual precipitation is 13 to 17 inches.

These soils are near most of the other soils in the survey area. These are the soils of the playa bottoms and in areas where surface water accumulates.

These soils are fine, montmorillonitic (calcareous), mesic Vertic Fluvaquents.

No pedon is typical, but the following one is common in an area of the Apishapa Family, ponded (0 to 1 percent slopes); about 2,304 feet west and 420 feet north of the southeast corner of sec. 27, T. 13 S., R. 46 W.

A—0 to 4 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, sticky and plastic; mildly alkaline; clear smooth boundary.

AC—4 to 12 inches; grayish brown (10YR 5/2) silty clay, dark brown (10YR 3/3) moist; weak medium prismatic structure; very hard, very firm, sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

C—12 to 28 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; very hard, very firm, sticky and very plastic; calcareous; moderately alkaline; few faint yellow and brown mottles; abrupt smooth boundary.

2C—28 to 29 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; massive; slightly hard, firm, slightly sticky and plastic; calcareous; moderately alkaline; abrupt smooth boundary.

3C1—29 to 54 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; very hard, very firm, very sticky and very plastic; calcareous; moderately alkaline; faint yellow and brown mottles; clear wavy boundary.

3C2—54 to 60 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; weak coarse prismatic structure; hard, firm, sticky and plastic; calcareous; moderately alkaline.

The depth to calcareous material is 0 to 10 inches. Thickness of the slowly permeable layer ranges from 24 to more than 60 inches. Reaction generally is mildly alkaline or moderately alkaline but is strongly alkaline in the lower part of some pedons.

The A horizon ranges from sandy loam to clay. It is 2 to 8 inches thick. The upper part of the C horizon ranges from 35 to 55 percent clay. The lower part is dominantly clay loam or silty clay loam, but it varies greatly in some areas.

Arvada Series

The Arvada series consists of deep, well drained soils on nearly level valley bottoms, stream terraces, and fans. These soils formed in clayey alluvium. Slope is 0 to 1 percent. The mean annual precipitation is 13 to 15 inches.

Arvada soils are near Deertrail and Manzanola soils. Manzanola soils have less than 15 percent exchangeable sodium. Deertrail soils have sodium accumulations in the lower part.

Arvada soils are fine, montmorillonitic, mesic Ustollic Natrargids.

Typical pedon of Arvada clay loam, in an area of Arvada-Deertrail complex, 0 to 1 percent slopes; about 750 feet east and 2,500 feet north of the southwest corner of sec. 8, T. 15 S., R. 48 W.

A—0 to 2 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong medium granular structure; slightly hard, firm, very sticky and plastic; calcareous; strongly alkaline; clear smooth boundary.

Btn—2 to 10 inches; dark brown (10YR 4/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure parting to strong medium subangular blocky; hard, firm, very sticky and very plastic; many bleached fine sand grains on faces of peds; calcareous; very strongly alkaline; clear smooth boundary.

Btkn—10 to 15 inches; pale brown (10YR 6/3) silty clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, firm, very sticky and very plastic; salt and gypsum crystals; calcareous; strongly alkaline; gradual wavy boundary.

Ckny—15 to 60 inches; pale brown (10YR 6/3) silty clay loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, sticky and plastic; salt and gypsum crystals; calcareous; strongly alkaline.

The depth to calcareous material is 0 to 12 inches. The calcium carbonate equivalent in the C horizon typically is 4 to 12 percent. The solum is 15 to 30 inches thick.

The A horizon has hue of 2.5Y or 10YR. It is mildly alkaline to strongly alkaline. The Bt horizon is clay, silty clay, silty clay loam, or clay loam. It has hue of 2.5Y to 7.5YR. This horizon is strongly alkaline or very strongly alkaline. It is 15 to 34 percent exchangeable sodium.

The C horizon has hue of 2.5Y to 7.5YR. It is strongly alkaline or very strongly alkaline. It typically is 10 to 30 percent exchangeable sodium, which generally decreases with increasing depth.

Ascalon Series

The Ascalon series consists of deep, well drained soils on upland plains, hill slopes, and ridges. These soils formed in mixed eolian and alluvial material. Slope is 0 to 20 percent. The average annual precipitation is 15 to 17 inches.

Ascalon soils are similar to Satanta and Olney soils and are near Manter, Satanta, and Eckley soils. Manter soils have less than 18 percent clay in the control section. Satanta soils have less than 35 percent fine sand or coarser sand in the argillic horizon. Eckley soils have a contrasting horizon at a depth of 10 to 20 inches.

Ascalon soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Ascalon sandy loam, 0 to 3 percent slopes, about 147 feet east and 2,448 feet south of the northwest corner of sec. 18, T. 14 S., R. 41 W.

Ap—0 to 6 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; abrupt smooth boundary.

Bt1—6 to 12 inches; brown (10YR 4/3) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and slightly plastic; mildly alkaline; clear smooth boundary.

Bt2—12 to 19 inches; brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

Bk—19 to 35 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and slightly plastic; calcareous; moderately alkaline; gradual smooth boundary.

C—35 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, firm, sticky and slightly plastic; calcareous; moderately alkaline.

The mollic epipedon is 7 to 20 inches thick. The depth to calcareous material is 8 to 30 inches. Depth to the base of the Bt horizon is 15 to 24 inches. The Bt horizon is 18 to 35 percent clay, 5 to 30 percent silt, and 45 to 75 percent sand. About 35 percent of the sand is fine sand or coarser sand.

Baca Series

The Baca series consists of deep, well drained soils on plains and in swales on uplands. These soils formed in loess. Slope is 0 to 3 percent. The average annual precipitation is 13 to 15 inches.

Baca soils are similar to Manzanola and Ulm soils and are near Colby and Wiley soils. Manzanola and Ulm soils have more than 15 percent fine sand or coarser sand. Wiley soils have less than 35 percent clay in the Bt horizon. Colby soils do not have a Bt horizon.

Baca soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Baca silt loam, 0 to 3 percent slopes, about 1,750 feet east and 250 feet south of the northwest corner of sec. 20, T. 14 S., R. 49 W.

Ap—0 to 3 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; weak thick platy structure; slightly hard, very friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

AB—3 to 6 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bt1—6 to 14 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; strong medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and plastic; neutral; clear smooth boundary.

Bt2—14 to 19 inches; brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and plastic; neutral; clear smooth boundary.

Bk—19 to 25 inches; grayish brown (10YR 5/2) silt loam, brown (10YR 4/3) moist; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C—25 to 60 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; calcareous; moderately alkaline.

The Bt horizon is clay, clay loam, silty clay, or silty clay loam. It ranges from 35 to 50 percent clay and from 5 to 40 percent sand. Less than 15 percent of the sand is coarser than very fine sand. The C horizon is silt loam or silty clay loam.

Bankard Series

The Bankard series consists of deep, somewhat excessively drained soils on low terraces and fans bordering intermittent drainageways. These soils formed in sandy alluvium. Slope is 0 to 1 percent. The average annual precipitation is about 13 to 17 inches.

Bankard soils are near Glenberg, Haverson, and Sampson soils. Glenberg soils have a coarse-loamy control section. Sampson soils are pachic. Haverson soils have a fine-loamy control section.

Bankard soils are sandy, mixed, mesic Ustic Torrifluvents.

Typical pedon of Bankard loamy sand, in an area of Glenberg-Bankard complex, 0 to 1 percent slopes; about 2,100 feet west and 2,640 feet north of the southeast corner of sec. 23, T. 13 S., R. 42 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; calcareous; mildly alkaline; clear smooth boundary.

AC—7 to 10 inches; light brownish gray (10YR 6/2) loamy sand, grayish brown (10YR 5/2) moist; very weak medium granular structure; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear smooth boundary.

C—10 to 60 inches; pale brown (10YR 6/3) sand stratified with thin layers of sandy loam and gravelly sand; light brownish gray (10YR 6/2) moist; single grain; loose, nonsticky and nonplastic; soft masses and streaks of calcium carbonate; calcareous; mildly alkaline.

These soils typically are calcareous throughout but are noncalcareous in the upper few inches in some pedons. The control section averages sand or loamy sand. The texture varies because of stratification. The A horizon has hue of 2.5Y to 7.5YR.

Bijou Series

The Bijou series consists of deep, somewhat excessively drained soils on uplands. These soils formed in noncalcareous, coarse textured and moderately coarse textured eolian and alluvial material. Slope is 0 to 6 percent. The average annual precipitation is 13 to 15 inches.

Bijou soils are similar to Vona soils and are near Valent and Olney soils. Vona soils are calcareous within a depth of 40 inches. Valent soils have no Bt horizon. Olney soils have more than 18 percent clay in the Bt horizon.

Bijou soils are coarse-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Bijou loamy sand, in an area of Valent-Vona-Bijou loamy sands, 4 to 12 percent slopes; about 1,936 feet north and 1,584 feet east of the southwest corner of sec. 32, T. 14 S., R. 47 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loamy sand, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

AB—3 to 5 inches; dark grayish brown (10YR 4/2) loamy sand, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

Bt—5 to 13 inches; brown (10YR 4/3) sandy loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and nonplastic; mildly alkaline; clear smooth boundary.

BC—13 to 18 inches; yellowish brown (10YR 5/4) loamy sand, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline; gradual wavy boundary.

C—18 to 60 inches; brown (10YR 5/3) sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; mildly alkaline.

The depth to calcareous material is 40 to more than 60 inches. Depth to the base of the Bt horizon is 12 to 40 inches. The Bt horizon ranges from 12 to 18 percent clay, 5 to 35 percent silt, and 52 to 75 percent sand.

Canyon Series

The Canyon series consists of shallow, well drained soils on ridgetops and knobs. These soils formed in material weathered from calcareous sandstone. Slope is 2 to 35 percent. The average annual precipitation is 13 to 17 inches.

Canyon soils are near the deep Kim, Schamber, and Stoneham soils. Schamber soils have more than 35 percent gravel in the control section. Stoneham soils have an argillic horizon.

Canyon soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of Canyon loam, in an area of Kim-Canyon loams, 2 to 5 percent slopes; about 800 feet east and 1,800 feet north of the southwest corner of sec. 6, T. 12 S., R. 45 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, slightly sticky and nonplastic; calcareous; mildly alkaline; clear smooth boundary.
AC—3 to 7 inches; gray (10YR 5/1) gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; about 15 percent fractured, limy sandstone fragments; calcareous; moderately alkaline; clear smooth boundary.
C—7 to 13 inches; light brownish gray (10YR 6/2) gravelly loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure parting to weak fine and medium subangular blocky; soft, friable, slightly sticky and nonplastic; about 20 percent fractured, limy sandstone fragments; calcareous; moderately alkaline; abrupt wavy boundary.
Cr—13 to 60 inches; white (10YR 8/2), partially cemented, fractured, calcareous sandstone; difficult to chip with a spade.

The depth to bedrock is 6 to 20 inches. The content of rock fragments ranges from 0 to 25 percent in all horizons. The profile is commonly calcareous throughout but may be noncalcareous in the A horizon. The C horizon ranges from 18 to 25 percent clay.

Colby Series

The Colby series consists of deep, well drained soils on hills, ridges, and side slopes. These soils formed in loess. Slope is 1 to 12 percent. The average annual precipitation is 13 to 17 inches.

Colby soils are near Keith, Ulysses, Satanta, Wiley, and Kim soils. Keith, Ulysses, and Satanta soils have a dark surface layer about 7 inches thick. Satanta and Kim soils have more sand in the control section than the Colby soils. Wiley soils are more strongly developed than the Colby soils.

Colby soils are fine-silty, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Colby silt loam, 1 to 4 percent slopes, eroded, about 2,225 feet south and 1,256 feet east of the northwest corner of sec. 31, T. 12 S., R. 41 W.

A—0 to 3 inches; grayish brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; calcareous; mildly alkaline; clear smooth boundary.
AC—3 to 12 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and nonplastic; calcareous; moderately alkaline; gradual wavy boundary.
Ck—12 to 28 inches; very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and nonplastic; calcareous; moderately alkaline; gradual wavy boundary.
C—28 to 60 inches; very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and nonplastic; calcareous; moderately alkaline.

These soils commonly are calcareous throughout. In some pedons, however, they are noncalcareous at a depth of 1 to 6 inches. The C horizon is silt loam or loam.

Deertrail Series

The Deertrail series consists of deep, well drained soils on broad upland flats. These soils formed in clayey alluvium derived dominantly from shale. Slope is 0 to 1 percent. The average annual precipitation is 13 to 15 inches.

Deertrail soils are near Arvada, Manzanola, and Fort Collins soils. Arvada soils have sodium accumulations near the surface and are characterized by slick spots. Manzanola soils do not have sodium accumulations. Fort Collins soils have less than 35 percent clay in the argillic horizon.

Deertrail soils are fine, montmorillonitic, mesic Haplustollic Natrargids.

Typical pedon of Deertrail loam, in an area of Arvada-Deertrail complex, 0 to 1 percent slopes; about 747 feet east and 2,500 feet north of the southwest corner of sec. 8, T. 15 S., R. 48 W.

A—0 to 2 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and nonplastic; mildly alkaline; clear smooth boundary.
Bt—2 to 7 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium columnar structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; many bleached fine sand grains on faces of peds; moderately alkaline; clear smooth boundary.
Btn—7 to 12 inches; pale brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) moist; weak

medium subangular blocky structure; hard, firm, sticky and plastic; calcareous; strongly alkaline; clear smooth boundary.

Btkn—12 to 25 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; salt and gypsum crystals and accumulations; calcareous; strongly alkaline; gradual smooth boundary.

Cnyz—25 to 60 inches; very pale brown (10YR 7/4) silt loam, pale brown (10YR 6/3) moist; massive; hard, firm, slightly sticky and slightly plastic; salt and gypsum crystals; calcareous; strongly alkaline.

The depth to calcareous material is 6 to 10 inches. The solum is 15 to 30 inches thick. Some pedons have a thin E horizon. The A horizon has hue of 2.5Y or 10YR. The content of exchangeable sodium is less than 15 percent in the upper part of the Bt horizon but is more than 15 percent in the lower part.

The Bt and C horizons have hue of 2.5Y or 10YR. The Bt horizon is clay loam, silty clay loam, or clay. The C horizon is clay loam, loam, silt loam, or silty clay loam.

Eckley Series

The Eckley series consists of deep, well drained soils on ridges, hills, and valley side slopes. These soils formed in mixed eolian and gravelly alluvium. Slope is 5 to 20 percent. The average annual precipitation is 15 to 17 inches.

Eckley soils are near Manter, Satanta, Ascalon, and Kim soils. The nearby soils do not have gravel in the substratum. Also, Kim soils do not have a dark surface layer or a subsoil.

Eckley soils are fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls.

Typical pedon of Eckley gravelly sandy loam, in an area of Ascalon-Eckley complex, 5 to 20 percent slopes; about 120 feet south and 500 feet west of the northeast corner of sec. 17, T. 13 S., R. 42 W.

A—0 to 4 inches; brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; about 20 percent pebbles; mildly alkaline; clear smooth boundary.

Bt—4 to 12 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; about 20 percent pebbles; mildly alkaline; clear wavy boundary.

BC—12 to 16 inches; brown and dark brown (7.5YR 4/4) very gravelly sandy loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; about 35 percent pebbles; neutral; gradual wavy boundary.

2C—16 to 60 inches; yellowish brown (10YR 5/4) very gravelly sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; about 35 percent pebbles; mildly alkaline.

Depth to the 2C horizon is 12 to 20 inches. The depth to calcareous material is 40 to more than 60 inches.

Firstview Series

The Firstview series consists of deep, well drained soils on nearly level terraces, fans, and valley bottoms in and adjacent to sandhills. These soils formed in mixed sandy material deposited over clayey alluvium. Slope is 0 to 3 percent. The mean annual precipitation is 13 to 15 inches.

Firstview soils are similar to Deertrail soils. They are near Vona, Olney, Manzanola, and Arvada soils. Deertrail and Arvada soils have a fine textured control section. Vona, Olney, and Manzanola soils are not natric.

Firstview soils are fine-loamy, mixed, mesic Ustollic Natrargids.

Typical pedon of Firstview sandy loam, 0 to 3 percent slopes, about 1,500 feet north and 40 feet east of the southwest corner of sec. 5, T. 15 S., R. 47 W.

E1—0 to 6 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; mildly alkaline (pH 7.4); clear smooth boundary.

E2—6 to 13 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; hard, firm, slightly sticky and slightly plastic; moderately alkaline (pH 7.8); clear smooth boundary.

Btkn—13 to 16 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; strong coarse prismatic structure parting to strong medium subangular blocky; hard, firm, slightly sticky and plastic; calcareous; strongly alkaline (pH 8.5); clear smooth boundary.

Btnz1—16 to 27 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak

coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, sticky and plastic; calcareous; strongly alkaline (pH 8.6); visible salt and gypsum crystals; gradual wavy boundary.

2Btnz2—27 to 40 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, very sticky and very plastic; calcareous; very strongly alkaline (pH 9.4); visible salt and gypsum crystals; gradual wavy boundary.

2Btnz3—40 to 58 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; massive; hard, friable, very sticky and very plastic; calcareous; strongly alkaline (pH 8.9); visible salt and gypsum crystals; clear wavy boundary.

Cnz—58 to 60 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, firm, slightly sticky and plastic; calcareous; strongly alkaline (pH 8.8); visible salt and gypsum crystals.

These soils generally are calcareous to the surface, but in some pedons the upper 14 inches is noncalcareous.

The E horizon is sandy loam or loamy sand. It has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. The content of organic matter in this horizon ranges from 0.6 to 1.0 percent.

The upper part of the Bt horizon is sandy clay loam with 15 percent sodium saturation. It is moderately alkaline or strongly alkaline. The lower part is clay loam or clay. It is strongly alkaline or very strongly alkaline. The Bt horizon has hue of 5Y to 10YR, value of 5 to 7, and chroma of 1 to 4.

The C horizon is moderately alkaline to very strongly alkaline. It has hue of 5Y to 7.5YR and chroma of 1 to 4.

Fluvaquents

These are deep, somewhat poorly drained and poorly drained soils on terraces near drainageways. The soils formed in alluvium. Slope is 0 to 1 percent. The mean annual precipitation is 13 to 17 inches.

Fluvaquents are near Haverson, Heldt, Glenberg, and Bankard soils. The nearby soils do not have a water table.

No pedon is typical, but the following one is common in an area of Fluvaquents, 0 to 1 percent slopes; about 1,600 feet east and 600 feet south of the northwest corner of sec. 23, T. 16 S., R. 47 W.

A—0 to 10 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

AC—10 to 15 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; calcareous; moderately alkaline; few yellow and brown mottles in the lower 5 inches; clear smooth boundary.

C—15 to 19 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; calcareous; strongly alkaline; few soft white calcium carbonate nodules; yellow and brown mottles; clear smooth boundary.

Cg—19 to 24 inches; light yellowish brown (10YR 6/4) sandy loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; many yellow and brown mottles; abrupt smooth boundary.

2Cg1—24 to 32 inches; yellowish brown (10YR 5/4) loamy sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; calcareous; many dark brown mottles; moderately alkaline; abrupt smooth boundary.

2Cg2—32 to 60 inches; very pale brown (10YR 7/4) gravelly sand, pale brown (10YR 6/3) moist; single grain; very soft, nonsticky and nonplastic; calcareous; large yellow mottles; few thin discontinuous strata and accumulations of gray (5Y 5/1) silty clay loam; moderately alkaline.

The depth to calcareous material is 0 to 15 inches. The surface layer is loamy sand to clay loam. The C horizon is stratified sand to clay. It is gravelly sand below a depth of 24 inches in some pedons. The water table is within a depth of 24 inches from March through June in most years.

Fort Collins Series

The Fort Collins series consists of deep, well drained soils on uplands. These soils formed in medium textured alluvium and eolian material. Slope is 0 to 5 percent. The average annual precipitation is 13 to 15 inches.

Fort Collins soils are similar to Stoneham and Olney soils. They are near Stoneham, Kim, Satanta, Ascalon, and Vona soils. Stoneham soils have an argillic horizon within a depth of 10 inches. Olney, Ascalon, and Vona soils have more than 35 percent fine sand or coarser sand in the control section. Kim soils do not have an argillic horizon. Satanta and Ascalon soils have a mollic

surface layer. Vona soils have less than 18 percent clay in the control section.

Fort Collins soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Fort Collins loam, 0 to 3 percent slopes, about 750 feet west and 201 feet north of the southeast corner of sec. 19, T. 14 S., R. 45 W.

Ap—0 to 5 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine granular; soft, friable, slightly sticky and nonplastic; mildly alkaline; abrupt smooth boundary.

Bt—5 to 18 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, slightly sticky and slightly plastic; very thin clay films on vertical faces of peds; mildly alkaline; clear smooth boundary.

Bk—18 to 28 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, firm, sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

Ck—28 to 42 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual smooth boundary.

C—42 to 60 inches; light yellowish brown (10YR 6/4) loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The solum is 15 to 30 inches thick. The depth to calcareous material is 8 to 20 inches. The content of rock fragments ranges from 0 to 15 percent but is typically less than 5 percent. The Bt horizon has hue of 7.5YR to 2.5Y. It is loam or clay loam. It is 18 to 35 percent clay and 15 to 35 percent fine sand or coarser sand. The C horizon has hue of 7.5YR to 2.5Y. It is moderately alkaline or strongly alkaline.

Glenberg Series

The Glenberg series consists of deep, well drained soils on low terraces and flood plains. These soils formed in sandy alluvium. Slope is 0 to 1 percent. The average annual precipitation is 13 to 17 inches.

Glenberg soils are near Bankard, Valent, and Haverson soils. Bankard soils have less clay in the control section than the Glenberg soils. Valent soils are not stratified. Haverson soils are more clayey than the Glenberg soils.

Glenberg soils are coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents.

Typical pedon of Glenberg sandy loam, in an area of Glenberg-Bankard complex, 0 to 1 percent slopes; about 1,320 feet west and 2,100 feet south of the northeast corner of sec. 2, T. 13 S., R. 42 W.

A—0 to 4 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy structure; slightly hard, very friable, slightly sticky and nonplastic; mildly alkaline; clear wavy boundary.

AC—4 to 10 inches; brown (10YR 5/3) sandy loam, brown and dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; abrupt wavy boundary.

C1—10 to 17 inches; brown (10YR 5/3) loamy sand, brown and dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; abrupt wavy boundary.

C2—17 to 24 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, sticky and slightly plastic; about 5 percent fine gravel; calcareous; moderately alkaline; abrupt wavy boundary.

C3—24 to 60 inches; pale brown (10YR 6/3), stratified sandy loam, loamy sand, and gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; calcareous; moderately alkaline.

Typically, these soils are calcareous throughout, but in some pedons they are noncalcareous in the upper few inches. The control section is stratified. It ranges from 5 to 18 percent clay. The A horizon has hue of 10YR or 2.5Y.

Goshen Series

The Goshen series consists of deep, well drained soils in nearly level or concave swales and poorly defined drainageways on terraces. These soils formed in silty alluvium. Slope is 0 to 1 percent. The average annual precipitation is 15 to 17 inches.

Goshen soils are near Keith, Ulysses, and Colby soils. Keith, Ulysses, and Colby soils are not mollic to a depth of 20 inches or more. Ulysses and Colby soils do not have argillic horizons.

Goshen soils are fine-silty, mixed, mesic Pachic Argiustolls.

Typical pedon of Goshen silt loam, 0 to 1 percent slopes, about 2,500 feet west and 200 feet north of the southeast corner of sec. 36, T. 14 S., R. 42 W.

A—0 to 4 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

Bt1—4 to 11 inches; dark brown (10YR 3/3) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine subangular blocky; hard, friable, sticky and plastic; thin continuous clay films; neutral; clear smooth boundary.

Bt2—11 to 21 inches; brown and dark brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to strong fine subangular blocky; hard, firm, sticky and plastic; thin continuous clay films; moderately alkaline; clear smooth boundary.

Bt3—21 to 27 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and slightly plastic; common thin clay films on vertical faces of peds; moderately alkaline; clear smooth boundary.

Bt4—27 to 35 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin patchy clay films; moderately alkaline; clear smooth boundary.

C—35 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The thickness of the solum ranges from 32 to 60 inches. The color of the upper 20 inches or more is dark enough to qualify as mollic. The control section is silt loam, loam, clay loam, or silty clay loam. It has 18 to 35 percent clay and less than 15 percent sand coarser than very fine sand.

Haverson Series

The Haverson series consists of deep, well drained soils on level and nearly level stream terraces and flood plains. These soils formed in mixed alluvium. Slope is 0 to 1 percent. The average annual precipitation is 13 to 17 inches.

Haverson soils are near Satanta, Bankard, Glenberg, and Fort Collins soils. Satanta soils have a mollic surface layer. Satanta and Fort Collins soils have an argillic horizon. Bankard and Glenberg soils have more sand throughout than the Haverson soils.

Haverson soils are fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents.

Typical pedon of Haverson loam, 0 to 1 percent slopes, about 2,100 feet south and 72 feet east of the northwest corner of sec. 27, T. 13 S., R. 42 W.

Ap—0 to 5 inches; light brownish gray (10YR 6/2) loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

C1—5 to 14 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; clear smooth boundary.

C2—14 to 60 inches; pale brown (10YR 6/3), stratified loam, clay loam, and sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The control section is stratified loam, clay loam, and sandy loam. It ranges from 18 to 35 percent clay, 10 to 50 percent silt, and 20 to 60 percent sand. More than 15 percent but less than 35 percent of the sand is fine sand or coarser sand.

Heldt Series

The Heldt series consists of deep, well drained soils on alluvial fans and terraces. These soils formed in clayey alluvium derived dominantly from shale. Slope is 0 to 1 percent. The average annual precipitation is 13 to 15 inches.

Heldt soils are near Manzanola, Razor, and Ulm soils. Razor soils are moderately deep over bedrock. Manzanola and Ulm soils have an argillic horizon and generally have less clay below a depth of 40 inches than the Heldt soils.

Heldt soils are fine, montmorillonitic, mesic Ustertic Camborthids.

Typical pedon of Heldt clay loam, 0 to 1 percent slopes, about 200 feet east and 416 feet north of the southwest corner of sec. 30, T. 12 S., R. 51 W.

A—0 to 5 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; slightly hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

Bw—5 to 15 inches; grayish brown (2.5Y 5/2) clay, olive brown (2.5Y 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular

blocky; very hard, very firm, very sticky and very plastic; few slickensides; calcareous; moderately alkaline; gradual smooth boundary.

Bk—15 to 28 inches; light olive brown (2.5Y 5/3) clay, olive brown (2.5Y 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; few slickensides; calcareous; moderately alkaline; gradual smooth boundary.

Ck—28 to 60 inches; light gray (2.5Y 7/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, very firm, very sticky and very plastic; few gypsum crystals and shale chips in the lower 4 inches; calcareous; moderately alkaline.

Lime is within a depth of 12 inches. The solum is 20 to 40 inches thick.

In the A horizon, cracks 2 millimeters to 1 centimeter wide are common during dry periods. The B horizon is dominantly clay, but it is silty clay, silty clay loam, or clay loam in some pedons. The C horizon ranges from 35 to 50 percent clay.

Keith Series

The Keith series consists of deep, well drained soils on uplands. These soils formed in loess. Slope is 0 to 2 percent. The average annual precipitation is 15 to 17 inches.

Keith soils are similar to Richfield soils. They are near Colby, Ulysses, and Goshen soils. Colby and Ulysses soils do not have a Bt horizon. Goshen soils are dark to a depth of more than 20 inches. Richfield soils have more than 35 percent clay in the argillic horizon.

Keith soils are fine-silty, mixed, mesic Aridic Argiustolls.

Typical pedon of Keith silt loam, in an area of Keith-Richfield silt loams, 0 to 2 percent slopes; about 600 feet south and 175 feet east of the northwest corner of sec. 16, T. 14 S., R. 42 W.

A—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and plastic; neutral; abrupt smooth boundary.

Bt1—6 to 10 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong fine prismatic structure parting to strong fine subangular blocky; hard, very friable, very sticky and plastic; mildly alkaline; clear wavy boundary.

Bt2—10 to 16 inches; light brownish gray (10YR 6/2) silty clay loam, brown and dark brown (10YR 4/3) moist; strong medium prismatic structure parting to strong medium subangular blocky; hard, very friable, sticky and plastic; moderately alkaline; clear wavy boundary.

Bk—16 to 25 inches; light brownish gray (10YR 6/2) silty clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, very friable, sticky and plastic; calcareous; moderately alkaline; gradual wavy boundary.

C1—25 to 40 inches; very pale brown (10YR 7/4) silt loam, pale brown (10YR 7/3) moist; weak coarse prismatic structure; slightly hard, very friable, sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C2—40 to 60 inches; very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The solum is 16 to 30 inches thick. The mollic epipedon is 8 to 20 inches thick. The Bt horizon is silt loam, silty clay loam, clay loam, or loam. It ranges from 20 to 35 percent clay. The C horizon is silt loam or loam. It has hue of 10YR to 2.5Y.

Kim Series

The Kim series consists of deep, well drained soils on gently sloping to sloping hills and ridges. These soils formed in mixed material derived from weathered, calcareous sedimentary rocks and loess. Slope is 1 to 15 percent. The average annual precipitation is 13 to 17 inches.

Kim soils are near Canyon, Satanta, Stoneham, and Midway soils. Canyon soils have soft, calcareous sandstone within a depth of 20 inches. Satanta soils have a mollic surface layer. Stoneham soils have an argillic horizon. Midway soils have shale within a depth of 20 inches.

Kim soils are fine-loamy, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Kim loam, in an area of Kim-Canyon loams, 2 to 5 percent slopes; near the center of sec. 20, T. 13 S., R. 42 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; abrupt smooth boundary.

AC—4 to 7 inches; light brownish gray (10YR 6/2) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky

and slightly plastic; calcareous; moderately alkaline; gradual wavy boundary.

C1—7 to 30 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual wavy boundary.

C2—30 to 60 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The content of rock fragments ranges from 0 to 15 percent throughout the profile. The soils generally are calcareous throughout but are noncalcareous in the upper few inches in some pedons.

Manter Series

The Manter series consists of deep, well drained soils on uplands. These soils formed dominantly in sandy eolian and alluvial material. Slope is 0 to 15 percent. The average annual precipitation is 15 to 17 inches.

Manter soils are near Satanta, Ascalon, and Eckley soils. Satanta and Ascalon soils have more clay than the Manter soils. Eckley soils are underlain by sand and gravel.

Manter soils are coarse-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Manter sandy loam, 1 to 3 percent slopes, about 1,500 feet north and 200 feet west of the southeast corner of sec. 35, T. 13 S., R. 42 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

BA—4 to 6 inches; brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, very friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

Bt1—6 to 16 inches; brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and nonplastic; clay evident as bridges and in root channels; neutral; clear wavy boundary.

Bt2—16 to 20 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable, slightly sticky and nonplastic; neutral; gradual wavy boundary.

Ck—20 to 35 inches; light gray (10YR 7/2) loamy fine sand, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; gradual wavy boundary.

C—35 to 60 inches; very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; massive and single grain; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline.

The depth to calcareous material is 12 to 30 inches. The solum is more than 15 inches thick. The Bt horizon ranges from 9 to 18 percent clay, 5 to 40 percent silt, and 52 to 85 percent sand.

Manzanola Series

The Manzanola series consists of deep, well drained soils on alluvial fans, terraces, and valley side slopes. These soils formed in alluvium and colluvium derived dominantly from calcareous shale. Slope is 0 to 3 percent. The average annual precipitation is 13 to 15 inches.

Manzanola soils are similar to Baca and Ulm soils and are near Heldt, Razor, Olney, and Stoneham soils. Baca soils have less than 15 percent fine sand or coarser sand in the argillic horizon. Ulm and Baca soils are noncalcareous to a depth of 8 inches or more. Heldt and Razor soils do not have an argillic horizon. Also, Razor soils are moderately deep over shale. Olney and Stoneham soils have less than 35 percent clay in the argillic horizon.

Manzanola soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Manzanola clay loam, 0 to 3 percent slopes, about 1,650 feet south and 1,410 feet west of the northeast corner of sec. 10, T. 14 S., R. 51 W.

A—0 to 5 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium granular structure; friable, firm, very sticky and plastic; calcareous; mildly alkaline; clear smooth boundary.

Bt—5 to 21 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, very sticky and very plastic; thin continuous clay films; calcareous; moderately alkaline; clear smooth boundary.

Btk—21 to 26 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to weak coarse subangular blocky; very hard, firm, sticky and

plastic; thin patchy clay films; many soft nodules of calcium carbonate; some streaks and seams of gypsum crystals; calcareous; moderately alkaline; clear smooth boundary.

Ck—26 to 36 inches; light gray (2.5Y 7/2) silty clay loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, sticky and plastic; some soft nodules of calcium carbonate; some streaks and seams of gypsum crystals; calcareous; moderately alkaline; abrupt wavy boundary.

C—36 to 60 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, sticky and plastic; many gypsum and salt crystals; calcareous; moderately alkaline; some thin strata of shale chips and sand below a depth of 50 inches.

Calcareous material is within a depth of 8 inches. The content of rock fragments ranges from 0 to 15 percent throughout the profile. The Bt horizon is clay loam, silty clay loam, or clay. The C horizon is clay loam or silty clay loam.

Midway Series

The Midway series consists of shallow, well drained soils on hills and ridges. These soils formed in material weathered from clayey shale. Slope is 6 to 15 percent. The average annual precipitation is 13 to 15 inches.

Midway soils are near Kim, Yoder, and Razor soils. Kim and Yoder soils do not have bedrock within a depth of 60 inches. Razor soils have shale bedrock at a depth of 20 to 40 inches.

Midway soils are clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of Midway clay loam, in an area of Kim-Midway complex, 6 to 15 percent slopes; about 1,221 feet west and 801 feet north of the southeast corner of sec. 7, T. 13 S., R. 45 W.

A—0 to 2 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak thin platy structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; abrupt smooth boundary.

AC—2 to 7 inches; light brownish gray (2.5Y 6/2) clay, light yellowish brown (2.5Y 6/4) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, very friable, very sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

C—7 to 13 inches; light gray (2.5Y 7/2) clay, pale yellow (2.5Y 7/4) moist; weak thin platy structure parting to weak fine subangular blocky; hard, very friable, very sticky and very plastic; calcareous; moderately alkaline; abrupt smooth boundary.

Cr—13 to 60 inches; light gray (2.5Y 7/2), clayey shale mottled with brownish yellow (10YR 6/8); few roots on vertical cleavage planes in the upper 2 inches.

The C horizon is silty clay loam, clay loam, or clay. The depth to shale is 6 to 20 inches.

Nunn Series

The Nunn series consists of deep, well drained soils on fans and terraces. These soils formed in calcareous alluvium. Slope is 0 to 2 percent. The average annual precipitation is 13 to 17 inches.

Nunn soils are near Satanta, Kim, and Stoneham soils. Kim and Stoneham soils have no mollic epipedon. Kim, Stoneham, and Satanta soils have less than 35 percent clay in the control section.

Nunn soils are fine, montmorillonitic, mesic Aridic Argiustolls.

Typical pedon of Nunn clay loam, 0 to 2 percent slopes, about 2,570 feet east and 50 feet south of the northwest corner of sec. 24, T. 14 S., R. 45 W.

Ap1—0 to 5 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and plastic; mildly alkaline; abrupt smooth boundary.

Ap2—5 to 9 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; mildly alkaline; abrupt smooth boundary.

Bt—9 to 19 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; thin continuous clay films; mildly alkaline; clear smooth boundary.

Bk—19 to 27 inches; light brownish gray (10YR 6/2) clay loam, brown (10YR 5/3) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, firm, very sticky and plastic; thin patchy clay films; calcareous; moderately alkaline; clear smooth boundary.

Ck—27 to 36 inches; light gray (10YR 7/2) clay loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to weak coarse

subangular blocky; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

C1—36 to 52 inches; very pale brown (10YR 7/3) clay loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, firm, very sticky and plastic; calcareous; moderately alkaline; gradual smooth boundary.

C2—52 to 60 inches; very pale brown (10YR 7/3) clay loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, sticky and plastic; about 3 percent fine pebbles; calcareous; strongly alkaline.

The mollic epipedon is 7 to 16 inches thick. The depth to calcareous material is 10 to 30 inches. The solum is 16 to 40 inches thick. The content of rock fragments is 0 to 15 percent throughout the profile. It increases with increasing depth.

The A and Bt horizons have hue of 2.5Y to 7.5YR. The content of clay in the Bt horizon ranges from 35 to 50 percent. The C horizon has hue of 7.5YR to 5Y.

Olney Series

The Olney series consists of deep, well drained soils on uplands. These soils formed in mixed eolian material and alluvium. Slope is 1 to 10 percent. The average annual precipitation is 13 to 15 inches.

Olney soils are similar to Ascalon, Stoneham, and Fort Collins soils and are near Manzanola, Vona, Bijou, Fort Collins, and Valent soils. Ascalon soils have a mollic surface layer. Stoneham soils have a solum that is less than 15 inches thick. Fort Collins soils have less than 35 percent fine sand or coarser sand. Bijou, Vona, and Valent soils have less than 18 percent clay. Manzanola soils have more than 35 percent clay.

Olney soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Olney sandy loam, 1 to 6 percent slopes, about 300 feet west and 300 feet south of the northeast corner of sec. 5, T. 13 S., R. 48 W.

Ap—0 to 4 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

BA—4 to 6 inches; yellowish brown (10YR 5/4) sandy clay loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, friable, sticky and slightly plastic; neutral; clear smooth boundary.

Bt1—6 to 10 inches; yellowish brown (10YR 5/4) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and slightly plastic; neutral; clear smooth boundary.

Bt2—10 to 14 inches; yellowish brown (10YR 5/4) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and slightly plastic; neutral; clear smooth boundary.

Bt3—14 to 18 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

Bk—18 to 23 inches; very pale brown (10YR 7/3) sandy loam, light yellowish brown (10YR 6/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

Ck—23 to 60 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) moist; massive; hard, very friable, slightly sticky and nonplastic; calcareous; moderately alkaline.

The depth to calcareous material is 10 to 24 inches. The solum is 15 to 30 inches thick.

Otero Series

The Otero series consists of deep, well drained soils on upland ridges and hills. These soils formed in mixed calcareous loess and alluvium. Slope is 3 to 6 percent. The average annual precipitation is 13 to 15 inches.

Otero soils are similar to Vona soils and are near Vona and Olney soils, both of which have an argillic horizon.

Otero soils are coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Otero sandy loam, in an area of Otero-Olney sandy loams, 3 to 6 percent slopes, eroded; about 519 feet west and 36 feet north of the southeast corner of sec. 31, T. 14 S., R. 48 W.

Ap—0 to 5 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak medium granular structure; soft, friable, nonsticky and nonplastic; calcareous; moderately alkaline; abrupt smooth boundary.

AC—5 to 18 inches; light yellowish brown (10YR 6/4) sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual smooth boundary.

Ck—18 to 39 inches; light yellowish brown (10YR 6/4)

sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; soft carbonate concretions as nodules and in seams; calcareous; moderately alkaline; gradual wavy boundary.

C—39 to 60 inches; very pale brown (10YR 7/4) sandy loam, brown (10YR 5/3) moist; massive; soft, friable, nonsticky and nonplastic; calcareous; moderately alkaline.

These soils typically are calcareous to the surface but in some pedons are noncalcareous to a depth of 6 inches. The 10- to 40-inch control section generally is sandy loam that ranges from 5 to 18 percent clay, 5 to 35 percent silt, and 50 to 82 percent sand.

Pultney Series

The Pultney series consists of moderately deep, well drained soils on gently sloping and moderately sloping hill slopes. These soils formed in material weathered from medium textured, gypsiferous shale. Slope is 2 to 9 percent. The mean annual precipitation is 13 to 15 inches.

Pultney soils are near Kim, Stoneham, and Fort Collins soils. The nearby soils are deep. Also, Stoneham and Fort Collins soils have an argillic horizon.

Pultney soils are fine-loamy, mixed, mesic Ustollic Calciorthids.

Typical pedon of Pultney very fine sandy loam, in an area of Kim-Pultney complex, 1 to 9 percent slopes; about 528 feet west and 528 feet south of the northeast corner of sec. 3, T. 16 S., R. 46 W.

A—0 to 4 inches; yellowish brown (10YR 5/4) very fine sandy loam, dark brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; abrupt smooth boundary.

AC—4 to 8 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

Ck—8 to 14 inches; light yellowish brown (10YR 6/4) clay loam, light olive brown (2.5Y 5/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; calcareous; moderately alkaline; gradual smooth boundary.

Cy—14 to 30 inches; light brownish gray (2.5Y 6/2) clay loam, pale olive (5Y 6/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, very sticky and very plastic; common gypsum crystals; calcareous; moderately alkaline; abrupt smooth boundary.

Cr—30 inches; soft, varicolored, medium textured shale.

These soils commonly are calcareous to the surface. The depth to paralithic contact is 20 to 40 inches. The control section is loam or clay loam. It ranges from 18 to 35 percent clay.

The A horizon has hue of 2.5Y or 10YR, value of 5 to 7, and chroma of 1 to 4. The C horizon has hue of 5Y to 10YR, value of 6 or 7, and chroma of 2 to 6. Calcium carbonate accumulations and soluble salt crystals are common in the lower part of this horizon.

Razor Series

The Razor series consists of moderately deep, well drained soils on gently sloping to sloping ridges, bench edges, and side slopes. These soils formed in residuum derived from soft, clayey shale. Slope is 1 to 12 percent. The average annual precipitation is 13 to 15 inches.

Razor soils are similar to Midway soils and are near Midway, Yoder, Kim, and Stoneham soils. Midway soils are less than 20 inches deep over bedrock. Yoder, Stoneham, and Kim soils contain less clay than the Razor soils and are more than 40 inches deep over bedrock.

Razor soils are fine, montmorillonitic, mesic Ustollic Camborthids.

Typical pedon of Razor clay loam, 1 to 6 percent slopes, about 1,980 feet west and 2,286 feet north of the southeast corner of sec. 27, T. 13 S., R. 49 W.

A—0 to 2 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, firm, sticky and plastic; mildly alkaline; abrupt smooth boundary.

Bw—2 to 11 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; moderately alkaline; clear smooth boundary.

Bk—11 to 15 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak medium prismatic structure; extremely hard, very firm, very sticky and very plastic; gypsum crystals in seams; calcareous; moderately alkaline; clear smooth boundary.

Ck—15 to 30 inches; light brownish gray (2.5Y 6/2) clay, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak fine

subangular blocky; extremely hard, very firm, very sticky and very plastic; many gypsum crystals; calcareous; moderately alkaline; abrupt smooth boundary.

Cr—30 to 60 inches; soft, platy clay shale; gypsum crystals between some plates; calcareous; mildly alkaline.

The depth to paralithic contact is 20 to 40 inches. The B and C horizons are clay loam or clay. The content of clay in these horizons is 35 to 50 percent.

Richfield Series

The Richfield series consists of deep, well drained soils in slightly concave or level areas on uplands. These soils formed in loess. Slope is 0 to 2 percent. The average annual precipitation is 15 to 17 inches.

Richfield soils are similar to Keith soils and are near Ulysses, Goshen, and Wiley soils. Keith, Ulysses, Goshen, and Wiley soils have less than 35 percent clay between depths of 10 and 40 inches. Goshen soils have 1 percent or more organic matter to a depth of more than 20 inches.

Richfield soils are fine, montmorillonitic, mesic Aridic Argiustolls.

Typical pedon of Richfield silt loam, in an area of Keith-Richfield silt loams, 0 to 2 percent slopes; about 2,532 feet north and 201 feet west of the southeast corner of sec. 14, T. 16 S., R. 42 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

Bt1—6 to 11 inches; brown (10YR 5/3) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; thin patchy clay films; neutral; clear smooth boundary.

Bt2—11 to 18 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; thin continuous clay films; mildly alkaline; gradual smooth boundary.

Btk—18 to 24 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, firm, sticky and plastic; very thin patchy clay films; calcareous; moderately alkaline; clear smooth boundary.

Ck—24 to 60 inches; light gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; many fine pores; free carbonates as streaks and soft nodules; calcareous; moderately alkaline.

The mollic epipedon is 10 to 20 inches thick. The solum is 16 to 30 inches thick. The Bt horizon is dominantly silty clay loam, but it is silty clay in some pedons. The C horizon is dominantly silt loam, but it is loam or silty clay loam in some pedons.

Sampson Series

The Sampson series consists of deep, well drained soils in upland swales and drainageways. These soils formed in calcareous alluvium. Slope is 0 to 2 percent. The average annual precipitation is 13 to 17 inches.

Sampson soils are similar to Satanta and Goshen soils. They are near Satanta, Keith, and Fort Collins soils. Satanta and Keith soils have a mollic epipedon that is less than 20 inches thick. Goshen soils have less than 15 percent fine sand or coarser sand in the control section. Fort Collins soils do not have a mollic surface layer.

Sampson soils are fine-loamy, mixed, mesic Pachic Argiustolls.

Typical pedon of Sampson loam, 0 to 2 percent slopes, about 402 feet north and 198 feet west of the southeast corner of sec. 30, T. 14 S., R. 45 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and nonplastic; mildly alkaline; clear smooth boundary.

AB—3 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and slightly plastic; mildly alkaline; clear smooth boundary.

Bt1—5 to 20 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, sticky and plastic; mildly alkaline; gradual smooth boundary.

Bt2—20 to 30 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; mildly alkaline; gradual smooth boundary.

Bk—30 to 50 inches; brown (10YR 5/3) clay loam, dark

grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C1—50 to 75 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C2—75 to 78 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The thickness of the mollic epipedon and the depth to calcium carbonate accumulations range from 20 to 40 inches. The Bt horizon is loam or clay loam.

Satanta Series

The Satanta series consists of deep, well drained soils on uplands and high stream terraces. These soils formed in mixed alluvium and eolian material. Slope is 0 to 9 percent. The average annual precipitation is 15 to 17 inches.

Satanta soils are similar to Ascalon soils. They are near Keith, Colby, Ascalon, and Manter soils. Ascalon soils have more than 35 percent sand in the subsoil. Keith and Colby soils have less sand and more silt than the Satanta soils, and Manter soils have less clay in the subsoil.

Satanta soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Satanta loam, in an area of Satanta-Colby complex, 3 to 5 percent slopes; about 800 feet west and 100 feet north of the southeast corner of sec. 36, T. 14 S., R. 43 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

A2—5 to 8 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bt—8 to 16 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, friable, sticky and slightly plastic; many thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bk1—16 to 21 inches; pale brown (10YR 6/3) loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual wavy boundary.

Bk2—21 to 28 inches; very pale brown (10YR 7/3) loam, light yellowish brown (10YR 6/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual wavy boundary.

C—28 to 60 inches; very pale brown (10YR 7/3) loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The solum is 20 to 40 inches thick. The mollic epipedon is 8 to 20 inches thick.

The Bt horizon is loam, clay loam, or sandy clay loam. It has hue of 7.5YR to 2.5Y. The C horizon has hue of 10YR or 2.5Y. It is loam, clay loam, or fine sandy loam.

Schamber Series

The Schamber series consists of deep, excessively drained soils that occur as gravelly edges and points on old high terraces. These soils formed in mixed eolian and outwash material that is shallow over sand and gravel. Slope is 6 to 35 percent. The average annual precipitation is 13 to 15 inches.

Schamber soils are near Stoneham, Vona, Manter, Razor, Yoder, and Fort Collins soils. Yoder soils have an argillic horizon. Manter soils are mollic, have an argillic horizon, and have less than 15 percent coarse fragments in the control section. Razor soils have a B horizon, have more than 35 percent clay, and are underlain by shale at a depth of 20 to 40 inches. Stoneham, Vona, and Fort Collins soils have an argillic horizon and have less than 15 percent coarse fragments in the control section.

Schamber soils are sandy-skeletal, mixed, mesic Ustic Torriorthents.

Typical pedon of Schamber very gravelly sandy loam, in an area of Schamber-Stoneham complex, 6 to 35 percent slopes; about 330 feet west and 1,236 feet north of the southeast corner of sec. 12, T. 12 S., R. 49 W.

A—0 to 3 inches; grayish brown (10YR 5/2) very gravelly sandy loam, very dark grayish brown (10YR

3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and slightly plastic; about 30 percent pebbles and 5 percent cobbles; neutral; abrupt smooth boundary.

AC—3 to 10 inches; brown (7.5YR 5/2) very gravelly sandy loam, dark brown (7.5YR 4/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and slightly plastic; about 40 percent pebbles and 10 percent cobbles; neutral; clear smooth boundary.

C1—10 to 18 inches; pinkish gray (7.5YR 6/2) very gravelly loamy sand, brown (7.5YR 5/2) moist; weak medium subangular blocky structure; loose, very friable, nonsticky and nonplastic; about 40 percent pebbles and 10 percent cobbles; carbonates on the underside of the pebbles and cobbles; calcareous; mildly alkaline; clear wavy boundary.

C2—18 to 60 inches; light gray (10YR 7/2) very gravelly sand, light brownish gray (10YR 6/2) moist; single grain; loose, nonsticky and nonplastic; about 40 percent pebbles and 5 percent cobbles; carbonates on the underside of the cobbles and pebbles; calcareous; mildly alkaline.

The content of rock fragments in the control section is 35 to 55 percent. The C horizon is very gravelly loamy sand or very gravelly sand.

Stoneham Series

The Stoneham series consists of deep, well drained soils on ridges, hills, and valley side slopes. These soils formed in calcareous, mixed material. Slope is 0 to 25 percent. The average annual precipitation is 13 to 15 inches.

Stoneham soils are similar to Fort Collins soils. They are near Schamber, Razor, Wiley, and Kim soils. Fort Collins soils have a solum that is more than 15 inches thick. Schamber, Razor, and Kim soils have no argillic horizon. Razor soils have shale bedrock at a depth of 20 to 40 inches. Schamber soils have sand and gravel within 10 inches of the surface. Wiley soils have less than 15 percent fine sand or coarser sand in the control section.

Stoneham soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Stoneham loam, 0 to 3 percent slopes, about 1,530 feet north and 300 feet west of the southeast corner of sec. 33, T. 13 S., R. 45 W.

Ap—0 to 3 inches; yellowish brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

Bt—3 to 7 inches; yellowish brown (10YR 5/4) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; thin continuous clay films; mildly alkaline; clear smooth boundary.

Btk—7 to 14 inches; very pale brown (10YR 7/4) loam, pale brown (10YR 6/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; thin patchy clay films; calcareous; mildly alkaline; clear smooth boundary.

Ck—14 to 21 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C1—21 to 46 inches; very pale brown (10YR 7/4) loam, pale brown (10YR 6/3) moist; massive; soft, friable, slightly sticky and slightly plastic; many fine pores; calcareous; moderately alkaline; abrupt wavy boundary.

C2—46 to 60 inches; pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; massive; hard, firm, sticky and plastic; calcareous; moderately alkaline.

The depth to calcareous material is 3 to 10 inches. The argillic horizon is 1 to 12 inches thick. Typically, the content of coarse fragments is about 2 or 3 percent, but it ranges from 0 to 15 percent. The A horizon has hue of 10YR to 2.5Y. It has granular or crumb structure. The Bt horizon has hue of 7.5YR to 2.5Y. It is loam, clay loam, or sandy clay loam. The C horizon has hue of 7.5YR to 2.5Y.

Sundance Series

The Sundance series consists of deep, well drained soils on flats that have poorly defined drainageways. These soils formed in sandy eolian material over loess. Slope is 0 to 3 percent. The average annual precipitation is 13 to 15 inches.

Sundance soils are similar to Fort Collins, Olney, and Stoneham soils and are near Bijou, Vona, and Valent soils. The similar and nearby soils do not have lithologic discontinuity. Bijou and Valent soils have a coarse-loamy control section.

Sundance soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Sundance loamy sand, 0 to 3 percent slopes, about 1,500 feet west and 786 feet north of the southeast corner of sec. 4, T. 16 S., R. 48 W.

Ap—0 to 8 inches; yellowish brown (10YR 5/4) loamy sand, brown (10YR 4/3) moist; weak medium granular structure; soft, very friable; neutral; abrupt smooth boundary.
Bt—8 to 16 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; very thin clay films on vertical faces of peds; neutral; clear smooth boundary.
2Btb—16 to 30 inches; dark brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and plastic; thin continuous clay films; mildly alkaline; abrupt smooth boundary.
2Bkb—30 to 50 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, very sticky and plastic; few soft carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.
2C—50 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable and sticky; many fine pores; calcareous; moderately alkaline.

The depth to calcareous material is 15 to 30 inches. Depth to the lithologic discontinuity is 10 to 30 inches.

Ulm Series

The Ulm series consists of deep, well drained soils on gently sloping side slopes and in drainageways. These soils formed in medium textured to moderately fine textured, calcareous alluvial material. Slope is 0 to 3 percent. The average annual precipitation is 13 to 15 inches.

Ulm soils are similar to Baca and Manzanola soils and are near Manzanola, Stoneham, and Olney soils. Baca soils have less than 15 percent fine sand or coarser sand. Manzanola soils have calcareous material within a depth of 12 inches. Stoneham and Olney soils have less than 35 percent clay in the control section.

Ulm soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Ulm loam, 0 to 3 percent slopes, about 1,761 feet north and 153 feet east of the southwest corner of sec. 34, T. 13 S., R. 47 W.

A—0 to 3 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.
BA—3 to 5 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, sticky and plastic; mildly alkaline; clear smooth boundary.
Bt—5 to 19 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, very sticky and very plastic; mildly alkaline; clear smooth boundary.
Btk—19 to 25 inches; brown (10YR 5/3) clay, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very friable, very sticky and very plastic; calcareous; moderately alkaline; gradual smooth boundary.
Bk—25 to 30 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; calcareous; moderately alkaline; gradual wavy boundary.
Ck—30 to 60 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The depth to calcareous material is 12 to 30 inches. The solum is 15 to 40 inches thick. The Bt horizon ranges from 35 to 50 percent clay.

Ulysses Series

The Ulysses series consists of deep, well drained soils on nearly level and gently undulating uplands. These soils formed in loess. Slope is 0 to 4 percent. The average annual precipitation is 15 to 17 inches.

Ulysses soils are near Keith and Colby soils. Keith soils have a Bt horizon. Colby soils do not have a mollic surface layer.

Ulysses soils are fine-silty, mixed, mesic Aridic Haplustolls.

Typical pedon of Ulysses silt loam, in an area of Keith-Ulysses silt loams, 1 to 4 percent slopes; about 2,500 feet south and 1,550 feet east of the northwest corner of sec. 16, T. 14 S., R. 42 W.

A—0 to 3 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.
AB—3 to 8 inches; dark grayish brown (10YR 4/2) silt

loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

Bw—8 to 12 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; calcareous; moderately alkaline; gradual wavy boundary.

Ck—12 to 31 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; few seams and streaks of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—31 to 60 inches; very pale brown (10YR 7/3) silt loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The mollic epipedon is 7 to 12 inches thick. The depth to calcareous material is 7 to 15 inches. The Bw horizon is silt loam or silty clay loam. The C horizon is silt loam or loam. Hue is 7.5YR to 2.5Y.

Valent Series

The Valent series consists of deep, excessively drained soils in areas of dunelike relief. These soils formed in sandy eolian material. Slope is 3 to 12 percent. The average annual precipitation is about 13 to 17 inches.

Valent soils are near Vona and Bijou soils, which have an argillic horizon.

Valent soils are mixed, mesic Ustic Torripsamments.

Typical pedon of Valent loamy sand, in an area of Valent-Vona-Bijou loamy sands, 4 to 12 percent slopes; about 700 feet south and 2,550 feet west of the northeast corner of sec. 4, T. 15 S., R. 48 W.

A—0 to 7 inches; yellowish brown (10YR 5/4) loamy sand, dark yellowish brown (10YR 4/4) moist; weak very fine granular structure; loose, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

AC—7 to 16 inches; yellowish brown (10YR 5/5) loamy sand, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable, nonsticky and nonplastic; mildly alkaline; gradual wavy boundary.

C—16 to 60 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; massive and single grain; loose, nonsticky and nonplastic; neutral.

These soils typically are noncalcareous throughout, but some pedons are calcareous below a depth of 40 inches. The control section is fine sand or loamy sand. The content of rock fragments is typically less than 2 percent throughout the profile. The soils are neutral or mildly alkaline throughout.

Vona Series

The Vona series consists of deep, somewhat excessively drained soils on ridges and hills. These soils formed in calcareous eolian material. Slope is 0 to 12 percent. The average annual precipitation is 13 to 15 inches.

Vona soils are similar to Bijou and Olney soils and are near Olney, Fort Collins, Valent, and Manter soils. Bijou soils do not have a calcareous C horizon. Olney and Fort Collins soils have more clay in the control section than the Vona soils. Valent soils do not have an argillic horizon and are more sandy in the control section than the Vona soils. Manter soils have a mollic epipedon.

Vona soils are coarse-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Vona loamy sand, 3 to 6 percent slopes, about 969 feet north of the southeast corner of sec. 33, T. 14 S., R. 47 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

Bt—4 to 10 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and slightly plastic; mildly alkaline; clear smooth boundary.

Btk—10 to 20 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual smooth boundary.

Ck1—20 to 32 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear wavy boundary.

Ck2—32 to 60 inches; pale brown (10YR 6/3) loamy

sand, brown (10YR 5/3) moist; massive; loose, very friable, nonsticky and nonplastic; calcareous; moderately alkaline.

The depth to calcareous material is 8 to 24 inches. The solum is 15 to 24 inches thick. The content of coarse fragments is 0 to 15 percent throughout the profile. The Bt horizon is fine sandy loam or sandy loam.

Weld Series

The Weld series consists of deep, well drained soils on upland flats. These soils formed in calcareous, silty loess. Slope is 0 to 1 percent. The average annual precipitation is 15 to 17 inches.

Weld soils are near Keith, Wiley, and Colby soils. The nearby soils have less than 35 percent clay in the control section. Colby soils do not have an argillic horizon. Wiley and Colby soils do not have a mollic surface layer.

Weld soils are fine, montmorillonitic, mesic Aridic Paleustolls.

Typical pedon of Weld silt loam, 0 to 1 percent slopes, about 30 feet east and 50 feet north of the southwest corner of sec. 31, T. 12 S., R. 45 W.

A—0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak thin platy structure parting to moderate fine granular; soft, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bt1—3 to 11 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine angular blocky; very hard, very firm, very sticky and very plastic; mildly alkaline; clear smooth boundary.

Bt2—11 to 15 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong medium and fine angular blocky; extremely hard, very firm, very sticky and very plastic; mildly alkaline; clear smooth boundary.

Btk—15 to 21 inches; brown (10YR 5/3) silty clay, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

Bk—21 to 31 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C—31 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, friable, slightly sticky and nonplastic; calcareous; moderately alkaline.

The content of clay in the upper part of the argillic horizon generally is at least double that of the overlying horizon. The depth to calcareous material is 8 to 20 inches. The thickness of the solum is 15 to 40 inches. The Bt horizon is 35 to 50 percent clay. The C horizon is silt loam or loam. It is moderately alkaline or strongly alkaline.

Wiley Series

The Wiley series consists of deep, well drained soils in nearly level and gently sloping areas on upland ridges, hills, and side slopes. These soils formed in calcareous, silty eolian material. Slope is 0 to 5 percent. The average annual precipitation is about 13 to 16 inches.

Wiley soils are near Colby, Kim, Keith, and Satanta soils. Colby and Kim soils do not have an argillic horizon. Keith and Satanta soils have a mollic epipedon and are noncalcareous to a depth of more than 7 inches. Kim and Satanta soils contain more than 15 percent fine sand or coarser sand.

Wiley soils are fine-silty, mixed, mesic Ustollic Haplargids.

Typical pedon of Wiley silt loam, in an area of Wiley complex, 3 to 5 percent slopes, eroded; about 600 feet south and 500 feet east of the northwest corner of sec. 8, T. 13 S., R. 44 W.

A—0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

Bt—3 to 15 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

Btk—15 to 23 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual wavy boundary.

Ck—23 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; calcareous; moderately alkaline.

Uniformly calcareous material typically is within a depth of 5 inches. Depth to the base of the argillic horizon is 12 to 30 inches. The C horizon is loam, silt loam, or very fine sandy loam.

Yoder Series

The Yoder series consists of deep, somewhat excessively drained soils on flats and gentle side slopes in the uplands. These soils formed in mixed loamy alluvium over sand and gravel. Slope is 0 to 25 percent. The average annual precipitation is 13 to 15 inches.

Yoder soils are near Stoneham, Razor, Kim, Olney, and Schamber soils. The nearby soils do not have strongly contrasting particle-size classes within their profiles.

Yoder soils are fine-loamy over sandy or sandy-skeletal, mixed, mesic Ustollic Haplargids.

Typical pedon of Yoder sandy loam, in an area of Yoder-Vona complex, 6 to 25 percent slopes; about 3,100 feet west of the southeast corner of sec. 19, T. 12 S., R. 48 W.

A—0 to 4 inches; yellowish brown (10YR 5/4) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

Bt—4 to 14 inches; dark yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; thin patchy clay films; waxlike coatings in pores and root channels; mildly alkaline; clear smooth boundary.

BC—14 to 17 inches; brownish yellow (10YR 6/6) gravelly sandy loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

2C1—17 to 50 inches; brownish yellow (10YR 6/6) gravelly loamy sand, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

2C2—50 to 60 inches; very pale brown (10YR 7/4) gravelly sand, brownish yellow (10YR 6/6) moist; massive; hard, very friable, slightly sticky and nonplastic; calcareous in spots; mildly alkaline.

The depth to uniformly calcareous material is 40 to more than 60 inches. Depth to the contrasting 2C horizon is 12 to 20 inches. Depth to the base of the argillic horizon is 10 to 20 inches.

Formation of the Soils

The following paragraphs relate the factors of soil formation to the soils in Cheyenne County. The major factors of soil formation are the physical and mineralogical composition of the parent material; the climate during and after the accumulation of the parent material; relief, or lay of the land; the plant and animal life in and on the soil; and the length of time that the forces of soil formation have acted on the parent material.

Climate and plant and animal life are the active forces of soil formation. They act on the parent material, decomposing, mixing, and moving the material, changing it into a natural body that has genetically related horizons. Relief modifies the effects of climate, vegetation, and biological activity. Finally, long periods of time are needed for the transformation of the parent material into a soil that has distinct horizons.

Parent Material

Parent material has had a strong influence on the soils in Cheyenne County. It has especially influenced chemical and physical properties, such as texture, color, consistence, and permeability.

Loess is the primary kind of parent material on the high, nearly level plains in the county. It consists of calcareous, silty material and fine sand. Weld, Wiley, Keith, and Colby are examples of soils that formed in loess.

Ogallala sand and gravel are apparent in the rolling and hilly areas. Eckley and Schamber are examples of soils that formed in these areas. Much of the Ogallala parent material has been mixed with the overlying loess, resulting in more loamy soils, such as Satanta, Fort Collins, Stoneham, and Ascalon soils.

Pierre Shale is near the surface in some areas north and west of Kit Carson. The shallow and moderately deep, clayey Midway and Razor soils are in these areas. The shale has a moderate content of soluble minerals and is the source of the accumulated soluble salts and sodium in the alluvial Arvada and Firstview soils.

Soils in the sandhills formed in sandy eolian or alluvial material. Valent, Vona, and Bijou are examples of soils that formed in this material.

Various alluvial mixtures of the parent materials are on terraces along intermittent streams. The soils that formed in alluvium are sandy soils, such as Bankard and Glenberg; loamy soils, such as Haverson and Sampson; and clayey soils, such as Heldt and Manzanola.

Climate

The climate in Cheyenne County is semiarid. It is characterized by extremes in temperature and precipitation. Winters are cold and dry, and summers are hot. Most of the 13- to 17-inch average annual precipitation falls in the period March through August. These climatic factors limit the growth of vegetation and biological activity. Periods of hot, dry days and high winds and intense thundershowers increase the hazard of erosion and further inhibit the soil-forming processes.

Plants and Animals

The vegetation in Cheyenne County is primarily short grasses. Mid and tall grasses grow in the sandhills and in areas where moisture accumulates. The amount of organic matter returned to the soil is low in most areas. The scarcity of organic matter and the climatic factors slow biological activity and limit it to the upper few feet of the soil. Vegetation has been the principal biological factor affecting soil formation in the county, but animals, insects, bacteria, and fungi also have been important. Differences in the content of organic matter, nitrogen, and plant nutrients in the soils and differences in soil structure and porosity are caused by plants and animals.

Relief

Relief is a very important factor of soil formation in Cheyenne County. The scarcity of moisture is the single

most important limitation of the soils. Relief controls the rapidity of runoff and amount of moisture that accumulates on and in the soils.

The depth of soil formation in soils that formed in similar kinds of parent material is related directly to the rate of water intake. Soils on slope breaks and the upper slopes commonly have a thin solum or show little evidence of horizon differentiation. The depth of soil formation increases as the slope decreases.

Time

Time is an especially important factor of soil formation in Cheyenne County, where the effects of the active soil-forming factors are limited. Quartzitic sand and gravel weather very slowly, whereas shale weathers moderately slowly and loess weathers easily. An example of the influence of time on soil formation is the high degree of horizonation in Weld soils, which are on old upland flats.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep to very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition of woody vegetation to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases production of forage, which reduces the hazard of erosion. It may improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles.

Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chemical treatment. Control of unwanted vegetation by use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil. Crop residue management helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops using a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Desert pavement. A layer of gravel or coarser fragments on a desert soil surface that was emplaced by the upward movement of fragments from underlying sediment or that remains after finer particles have been removed by running water or by wind.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition

between the less decomposed fibric and the more decomposed sapric material.

High-residue crops. Crops such as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low

0.75 to 1.25 ..... moderate
1.25 to 1.75 ..... moderately high
1.75 to 2.5 ..... high
More than 2.5 ..... very high

Intermittent stream. A stream or reach of a stream that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Crops such as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat-topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper,

boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed. (See Climax plant community.)

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. Proper grazing use increases the vigor and reproduction of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is

the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks,

prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay*

loam, sandy clay, silty clay, and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-78 at Kit Carson, Colorado)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	44.0	11.0	27.5	71	-16	12	0.25	---	0.43	1	3.6
February----	49.6	16.4	33.0	76	-8	50	.23	.01	.39	1	3.6
March-------	55.7	22.0	38.9	83	-3	131	.60	.09	1.00	2	4.7
April-------	66.9	33.0	50.0	88	13	309	1.01	.24	1.63	3	2.3
May---------	76.6	43.8	60.2	97	26	626	2.22	1.22	3.08	5	.6
June--------	87.4	53.5	70.5	105	37	915	1.79	.57	2.78	4	.0
July--------	92.5	59.1	75.8	106	47	1,110	2.19	1.00	3.20	5	.0
August------	90.6	56.7	73.7	103	42	1,045	2.04	.57	3.22	5	.0
September---	82.2	47.2	64.6	100	30	738	1.26	.31	2.01	3	.2
October-----	71.6	34.7	53.2	91	16	409	.82	.09	1.37	2	1.0
November----	54.5	22.1	38.4	78	-3	63	.49	.11	.79	2	3.9
December----	46.4	14.0	30.2	71	-11	22	.28	.01	.47	1	4.2
Yearly:											
Average---	68.2	34.5	51.3	---	---	---	---	---	---	---	---
Extreme---	---	---	---	107	-18	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,430	13.18	9.65	16.77	34	24.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-78 at Kit Carson, Colorado)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 28	May 9	May 21
2 years in 10 later than--	Apr. 24	May 5	May 16
5 years in 10 later than--	Apr. 15	Apr. 26	May 7
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 13	Sept. 26	Sept. 16
2 years in 10 earlier than--	Oct. 17	Oct. 1	Sept. 22
5 years in 10 earlier than--	Oct. 24	Oct. 11	Oct. 2

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-78 at Kit Carson, Colorado)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	173	148	124
8 years in 10	179	155	132
5 years in 10	191	168	148
2 years in 10	203	181	163
1 year in 10	210	188	171

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Apishapa Family, ponded	2,056	0.2
2	Arvada-Deertrail complex, 0 to 1 percent slopes	5,886	0.5
3	Ascalon sandy loam, 0 to 3 percent slopes	5,794	0.5
4	Ascalon sandy loam, 3 to 5 percent slopes	1,855	0.2
5	Ascalon-Eckley complex, 5 to 20 percent slopes	3,022	0.3
6	Baca silt loam, 0 to 3 percent slopes	12,919	1.1
7	Bijou loamy sand, 0 to 3 percent slopes	10,105	0.9
8	Colby silt loam, 1 to 4 percent slopes, eroded	27,838	2.4
9	Colby silt loam, 4 to 12 percent slopes	4,951	0.4
10	Colby-Satanta complex, 5 to 12 percent slopes	12,007	1.1
11	Firstview sandy loam, 0 to 3 percent slopes	5,585	0.5
12	Fluvaquents, 0 to 1 percent slopes	1,515	0.1
13	Fort Collins loam, 0 to 3 percent slopes	48,002	4.2
14	Fort Collins-Vona complex, 0 to 3 percent slopes	6,001	0.5
15	Glenberg-Bankard complex, 0 to 1 percent slopes	21,536	1.9
16	Goshen silt loam, 0 to 1 percent slopes	19,681	1.7
17	Haverson loam, 0 to 1 percent slopes	8,112	0.7
18	Heldt clay loam, 0 to 1 percent slopes	1,485	0.1
19	Keith-Richfield silt loams, 0 to 2 percent slopes	82,776	7.3
20	Keith-Ulysses silt loams, 1 to 4 percent slopes	93,035	8.2
21	Kim loam, 1 to 3 percent slopes, eroded	6,073	0.5
22	Kim loam, 3 to 12 percent slopes	7,689	0.7
23	Kim-Canyon loams, 2 to 5 percent slopes	2,015	0.2
24	Kim-Canyon loams, 5 to 35 percent slopes	2,534	0.2
25	Kim-Midway complex, 6 to 15 percent slopes	9,472	0.8
26	Kim-Pultney complex, 1 to 9 percent slopes	2,137	0.2
27	Manter sandy loam, 1 to 3 percent slopes	2,722	0.2
28	Manter sandy loam, 3 to 5 percent slopes	2,867	0.3
29	Manter sandy loam, 5 to 15 percent slopes	3,970	0.3
30	Manzanola clay loam, 0 to 3 percent slopes	25,890	2.3
31	Nunn clay loam, 0 to 2 percent slopes	5,033	0.4
32	Olney sandy loam, 1 to 6 percent slopes	42,837	3.8
33	Olney-Manzanola complex, 0 to 6 percent slopes	15,701	1.4
34	Otero-Olney sandy loams, 3 to 6 percent slopes, eroded	5,618	0.5
35	Razor clay loam, 1 to 6 percent slopes	13,412	1.2
36	Razor-Midway clay loams, 6 to 12 percent slopes	6,912	0.6
37	Sampson loam, 0 to 2 percent slopes	19,796	1.7
38	Satanta loam, 0 to 3 percent slopes	42,750	3.7
39	Satanta-Colby complex, 3 to 5 percent slopes	40,989	3.6
40	Schamber-Stoneham complex, 6 to 35 percent slopes	4,461	0.4
41	Stoneham loam, 0 to 3 percent slopes	43,939	3.9
42	Stoneham loam, 3 to 6 percent slopes	45,789	4.0
43	Stoneham-Kim loams, 6 to 12 percent slopes	9,439	0.8
44	Stoneham-Razor complex, 2 to 6 percent slopes	5,797	0.5
45	Sundance loamy sand, 0 to 3 percent slopes	14,683	1.3
46	Ulm loamy sand, 0 to 3 percent slopes	2,940	0.3
47	Ulm loam, 0 to 3 percent slopes	21,664	1.9
48	Valent loamy sand, 3 to 12 percent slopes	59,208	5.2
49	Valent-Vona-Bijou loamy sands, 4 to 12 percent slopes	80,230	7.0
50	Vona loamy sand, 0 to 3 percent slopes, eroded	7,114	0.6
51	Vona loamy sand, 3 to 6 percent slopes	20,053	1.8
52	Vona-Olney complex, 3 to 12 percent slopes	10,328	0.9
53	Weld silt loam, 0 to 1 percent slopes	11,444	1.0
54	Wiley complex, 0 to 3 percent slopes, eroded	130,865	11.4
55	Wiley complex, 3 to 5 percent slopes, eroded	19,011	1.7
56	Yoder-Stoneham complex, 0 to 6 percent slopes	7,715	0.7
57	Yoder-Vona complex, 6 to 25 percent slopes	13,779	1.2
	Total	1,141,037	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
3	Ascalon sandy loam, 0 to 3 percent slopes (where irrigated)
4	Ascalon sandy loam, 3 to 5 percent slopes (where irrigated)
6	Baca silt loam, 0 to 3 percent slopes (where irrigated)
8	Colby silt loam, 1 to 4 percent slopes, eroded (where irrigated)
13	Fort Collins loam, 0 to 3 percent slopes (where irrigated)
16	Goshen silt loam, 0 to 1 percent slopes (where irrigated)
17	Haverson loam, 0 to 1 percent slopes (where irrigated)
18	Heldt clay loam, 0 to 1 percent slopes (where irrigated)
19	Keith-Richfield silt loams, 0 to 2 percent slopes (where irrigated)
20	Keith-Ulysses silt loams, 1 to 4 percent slopes (where irrigated)
21	Kim loam, 1 to 3 percent slopes, eroded (where irrigated)
27	Manter sandy loam, 1 to 3 percent slopes (where irrigated)
28	Manter sandy loam, 3 to 5 percent slopes (where irrigated)
30	Manzanola clay loam, 0 to 3 percent slopes (where irrigated)
31	Nunn clay loam, 0 to 2 percent slopes (where irrigated)
32	Olney sandy loam, 1 to 6 percent slopes (where irrigated)
33	Olney-Manzanola complex, 0 to 6 percent slopes (where irrigated)
34	Otero-Olney sandy loams, 3 to 6 percent slopes, eroded (where irrigated)
37	Sampson loam, 0 to 2 percent slopes (where irrigated)
38	Satanta loam, 0 to 3 percent slopes (where irrigated)
39	Satanta-Colby complex, 3 to 5 percent slopes (where irrigated)
41	Stoneham loam, 0 to 3 percent slopes (where irrigated)
42	Stoneham loam, 3 to 6 percent slopes (where irrigated)
47	Ulm loam, 0 to 3 percent slopes (where irrigated)
53	Weld silt loam, 0 to 1 percent slopes (where irrigated)
54	Wiley complex, 0 to 3 percent slopes, eroded (where irrigated)
55	Wiley complex, 3 to 5 percent slopes, eroded (where irrigated)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Wheat		Grain sorghum		Corn		Sugar beets	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
1---------- Apishapa	VIw	---	---	---	---	---	---	---	---	---
2---------- Arvada-Deertrail	VIIs	---	---	---	---	---	---	---	---	---
3---------- Ascalon	IIIe	IIe	25	60	19	80	---	140	---	20
4---------- Ascalon	IVe	IIIe	22	55	17	70	---	130	---	18
5---------- Ascalon-Eckley	VIe	---	---	---	---	---	---	---	---	---
6---------- Baca	IVe	---	21	---	---	---	---	---	---	---
7---------- Bijou	IVe	---	15	---	25	---	---	---	---	---
8---------- Colby	IVe	IIIe	18	45	16	65	---	100	---	16
9---------- Colby	VIe	---	---	---	---	---	---	---	---	---
10---------- Colby-Satanta	VIe	---	---	---	---	---	---	---	---	---
11---------- Firstview	VIIs	---	---	---	---	---	---	---	---	---
12---------- Fluvaquents	VIw	---	---	---	---	---	---	---	---	---
13---------- Fort Collins	IVe	---	22	---	---	---	---	---	---	---
14---------- Fort Collins-Vona	IVe	---	20	---	23	---	---	---	---	---
15---------- Glenberg-Bankard	VIe	---	---	---	---	---	---	---	---	---
16---------- Goshen	IIIe	IIe	28	65	35	90	---	135	---	24
17---------- Haverson	IVe	IIe	20	50	19	70	---	125	---	19
18---------- Heldt	IVs	---	---	---	---	---	---	---	---	---
19---------- Keith-Richfield	IIIe	IIe	26	65	30	90	---	135	---	22

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Wheat		Grain sorghum		Corn		Sugar beets	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
20--Keith-Ulysses	IVe	IIe	23	60	27	80	---	130	---	20
21--Kim	IVe	---	17	---	15	---	---	---	---	---
22--Kim	VIe	---	---	---	---	---	---	---	---	---
23--Kim-Canyon	IVe	---	15	---	13	---	---	---	---	---
24--Kim-Canyon	VIe	---	---	---	---	---	---	---	---	---
25--Kim-Midway	VIe	---	---	---	---	---	---	---	---	---
26--Kim-Pultney	VIe	---	---	---	---	---	---	---	---	---
27--Manter	IIIe	IIIe	20	55	17	70	---	130	---	18
28--Manter	IVe	IIIe	18	55	15	70	---	120	---	16
29--Manter	VIe	---	---	---	---	---	---	---	---	---
30--Manzanola	IVe	---	16	---	---	---	---	---	---	---
31--Nunn	IIIe	IIe	25	60	---	---	---	130	---	---
32--Olney	IVe	---	18	---	25	---	---	---	---	---
33--Olney-Manzanola	IVe	---	17	---	17	---	---	---	---	---
34--Otero-Olney	VIe	---	---	---	---	---	---	---	---	---
35--Razor	VIe	---	---	---	---	---	---	---	---	---
36--Razor-Midway	VIIe	---	---	---	---	---	---	---	---	---
37--Sampson	IIIe	IIe	25	60	30	90	---	140	---	24
38--Satanta	IIIe	IIe	25	60	30	90	---	135	---	23
39--Satanta-Colby	IVe	IIIe	23	55	25	80	---	130	---	20

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Wheat		Grain sorghum		Corn		Sugar beets	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
40--Schamber-Stoneham	VIIe	---	---	---	---	---	---	---	---	---
41--Stoneham	IVe	---	18	---	18	---	---	---	---	---
42--Stoneham	IVe	---	16	---	16	---	---	---	---	---
43--Stoneham-Kim	VIe	---	---	---	---	---	---	---	---	---
44--Stoneham-Razor	IVe	---	14	---	14	---	---	---	---	---
45--Sundance	IVe	---	19	---	35	---	---	---	---	---
46--Ulm	IVe	---	---	---	---	---	---	---	---	---
47--Ulm	IVe	---	19	---	---	---	---	---	---	---
48--Valent	VIe	---	---	---	---	---	---	---	---	---
49--Valent-Vona-Bijou	VIe	---	---	---	---	---	---	---	---	---
50--Vona	IVe	---	19	---	20	---	---	---	---	---
51--Vona	VIe	---	---	---	---	---	---	---	---	---
52--Vona-Olney	VIe	---	---	---	---	---	---	---	---	---
53--Weld	IIIe	IIe	25	60	20	100	---	135	---	21
54--Wiley	IVe	IIe	20	55	18	65	---	125	---	18
55--Wiley	IVe	---	19	---	17	---	---	---	---	---
56--Yoder-Stoneham	IVe	---	15	---	---	---	---	---	---	---
57--Yoder-Vona	VIe	---	---	---	---	---	---	---	---	---

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1---------- Apishapa	Plains Swale----------	Favorable	1,800	Western wheatgrass----------	70
		Normal	1,100	Blue grama----------	10
		Unfavorable	800	Buffalograss----------	5
				Sedge----------	5
				Inland saltgrass----------	5
2*:					
Arvada----------	Salt Flat----------	Favorable	1,500	Alkali sacaton----------	30
		Normal	900	Blue grama----------	15
		Unfavorable	500	Western wheatgrass----------	15
				Nuttall alkaligrass----------	10
				Inland saltgrass----------	10
				Fourwing saltbush----------	5
Deertrail---------	Alkaline Plains----------	Favorable	2,000	Alkali sacaton----------	35
		Normal	1,300	Blue grama----------	20
		Unfavorable	700	Western wheatgrass----------	15
				Galleta grass----------	15
				Bottlebrush squirreltail------	5
3, 4---------- Ascalon	Sandy Plains----------	Favorable	2,300	Blue grama----------	25
		Normal	1,600	Prairie sandreed----------	25
		Unfavorable	800	Thickspike wheatgrass---------	10
				Needleandthread----------	10
				Sideoats grama----------	10
				Sedge----------	5
				Sand bluestem----------	5
				Sand sagebrush----------	2
5*:					
Ascalon----------	Sandy Plains----------	Favorable	2,300	Blue grama----------	25
		Normal	1,600	Prairie sandreed----------	25
		Unfavorable	800	Thickspike wheatgrass---------	10
				Needleandthread----------	10
				Sideoats grama----------	10
				Sedge----------	5
				Sand bluestem----------	5
				Sand sagebrush----------	2
Eckley----------	Gravel Breaks----------	Favorable	1,400	Blue grama----------	20
		Normal	900	Little bluestem----------	20
		Unfavorable	600	Sideoats grama----------	15
				Needleandthread----------	10
				Prairie sandreed----------	10
				Sedge----------	5
6---------- Baca	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
		Normal	1,000	Western wheatgrass----------	30
		Unfavorable	500	Green needlegrass----------	10
				Buffalograss----------	5
				Sedge----------	5
				Needleandthread----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
7---------- Bijou	Sandy Plains----------	Favorable	2,000	Prairie sandreed----------	20
		Normal	1,600	Blue grama----------	15
		Unfavorable	800	Sand bluestem----------	10
				Sand dropseed----------	5
				Needleandthread----------	5
				Little bluestem----------	5
				Sideoats grama----------	5
				Thickspike wheatgrass---------	5
				Sand sagebrush----------	3
8---------- Colby	Loamy Plains----------	Favorable	1,600	Blue grama----------	35
		Normal	1,100	Western wheatgrass----------	25
		Unfavorable	600	Sideoats grama----------	10
				Green needlegrass----------	10
				Needleandthread----------	5
				Buffalograss----------	5
				Sand dropseed----------	5
9---------- Colby	Loamy Slopes----------	Favorable	1,200	Blue grama----------	40
		Normal	800	Western wheatgrass----------	30
		Unfavorable	500	Green needlegrass----------	10
				Buffalograss----------	5
				Sideoats grama----------	5
				Sedge----------	5
10*:					
Colby----------	Loamy Slopes----------	Favorable	1,200	Blue grama----------	40
		Normal	800	Western wheatgrass----------	30
		Unfavorable	500	Green needlegrass----------	10
				Buffalograss----------	5
				Sideoats grama----------	5
				Sedge----------	5
Satanta----------	Loamy Plains----------	Favorable	1,650	Blue grama----------	35
		Normal	1,050	Western wheatgrass----------	30
		Unfavorable	500	Needleandthread----------	10
				Green needlegrass----------	10
				Other perennial forbs---------	5
11---------- Firstview	Sandy Salt Flat----------	Favorable	2,200	Alkali sacaton----------	35
		Normal	1,400	Blue grama----------	20
		Unfavorable	700	Western wheatgrass----------	10
				Switchgrass----------	10
				Sand bluestem----------	10
				Inland saltgrass----------	5
				Sand sagebrush----------	5
12---------- Fluvaquents	Salt Meadow----------	Favorable	3,000	Alkali sacaton----------	40
		Normal	2,500	Switchgrass----------	15
		Unfavorable	1,000	Western wheatgrass----------	15
				Inland saltgrass----------	10
				Sedge----------	10

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
13---------- Fort Collins	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
		Normal	1,100	Western wheatgrass----------	30
		Unfavorable	800	Green needlegrass----------	10
				Buffalograss----------	5
				Sedge----------	5
				Fourwing saltbush----------	5
				Needleandthread----------	5
14*:					
Fort Collins------	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
		Normal	1,100	Western wheatgrass----------	30
		Unfavorable	800	Green needlegrass----------	10
				Buffalograss----------	5
				Sedge----------	5
				Fourwing saltbush----------	5
				Needleandthread----------	5
Vona----------	Sandy Plains----------	Favorable	2,200	Prairie sandreed----------	25
		Normal	1,700	Blue grama----------	20
		Unfavorable	900	Little bluestem----------	10
				Sideoats grama----------	10
				Sand bluestem----------	5
				Sand dropseed----------	5
				Switchgrass----------	5
				Sand sagebrush----------	5
15*:					
Glenberg----------	Sandy Bottomland----------	Favorable	2,500	Switchgrass----------	20
		Normal	2,000	Prairie sandreed----------	10
		Unfavorable	1,300	Sand bluestem----------	10
				Needlegrass----------	10
				Western wheatgrass----------	5
				Sand dropseed----------	5
				Little bluestem----------	5
				Blue grama----------	5
				Sedge----------	5
Bankard----------	Sandy Bottomland----------	Favorable	2,500	Switchgrass----------	20
		Normal	1,750	Needleandthread----------	15
		Unfavorable	750	Sand bluestem----------	15
				Prairie sandreed----------	15
				Blue grama----------	5
				Western wheatgrass----------	5
				Sand dropseed----------	5
				Sedge----------	5
				Other perennial grasses-------	5
16---------- Goshen	Overflow----------	Favorable	2,800	Western wheatgrass----------	35
		Normal	2,000	Green needlegrass----------	20
		Unfavorable	1,200	Blue grama----------	10
				Switchgrass----------	10
				Big bluestem----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
17---------- Haverson	Overflow----------	Favorable	2,800	Western wheatgrass----------	35
		Normal	2,000	Green needlegrass----------	15
		Unfavorable	1,200	Switchgrass----------	15
				Blue grama----------	10
				Big bluestem----------	5
				Buffalograss----------	5
18---------- Heldt	Clayey Plains----------	Favorable	1,300	Blue grama----------	25
		Normal	900	Western wheatgrass----------	25
		Unfavorable	500	Alkali sacaton----------	10
				Buffalograss----------	5
				Bottlebrush squirreltail------	5
				Green needlegrass----------	5
				Fourwing saltbush----------	5
				Galleta----------	5
19*:					
Keith----------	Loamy Plains----------	Favorable	1,800	Western wheatgrass----------	35
		Normal	1,400	Green needlegrass----------	20
		Unfavorable	1,000	Blue grama----------	20
				Needleandthread----------	5
				Buffalograss----------	5
				Little bluestem----------	5
Richfield---------	Loamy Plains----------	Favorable	1,700	Blue grama----------	35
		Normal	1,300	Western wheatgrass----------	30
		Unfavorable	900	Green needlegrass----------	20
				Buffalograss----------	5
20*:					
Keith----------	Loamy Plains----------	Favorable	1,700	Western wheatgrass----------	35
		Normal	1,150	Blue grama----------	30
		Unfavorable	600	Green needlegrass----------	20
				Needleandthread----------	5
				Buffalograss----------	5
Ulysses----------	Loamy Plains----------	Favorable	1,700	Blue grama----------	40
		Normal	1,150	Western wheatgrass----------	30
		Unfavorable	600	Green needlegrass----------	15
				Needleandthread----------	5
				Sand dropseed----------	5
				Sedge----------	5
21---------- Kim	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
		Normal	1,000	Western wheatgrass----------	30
		Unfavorable	500	Green needlegrass----------	10
				Sand dropseed----------	5
				Needleandthread----------	5
22---------- Kim	Loamy Slopes----------	Favorable	1,200	Blue grama----------	35
		Normal	900	Western wheatgrass----------	30
		Unfavorable	450	Needleandthread----------	10
				Sideoats grama----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
23*:					
Kim	Loamy Plains	Favorable	1,600	Blue grama	40
		Normal	1,000	Western wheatgrass	30
		Unfavorable	500	Green needlegrass	10
				Sand dropseed	5
				Needleandthread	5
Canyon	Limestone Breaks	Favorable	1,000	Little bluestem	25
		Normal	800	Sideoats grama	25
		Unfavorable	550	Blue grama	15
				Threadleaf sedge	5
				Needleandthread	5
				Western wheatgrass	5
				Other perennial forbs	5
				Other shrubs	5
24*:					
Kim	Loamy Slopes	Favorable	1,200	Blue grama	35
		Normal	900	Western wheatgrass	30
		Unfavorable	450	Needleandthread	10
				Sideoats grama	5
Canyon	Limestone Breaks	Favorable	1,000	Little bluestem	25
		Normal	800	Sideoats grama	25
		Unfavorable	550	Blue grama	15
				Threadleaf sedge	5
				Needleandthread	5
				Western wheatgrass	5
				Other perennial forbs	5
				Other shrubs	5
25*:					
Kim	Loamy Slopes	Favorable	1,200	Blue grama	35
		Normal	900	Western wheatgrass	30
		Unfavorable	450	Needleandthread	10
				Sideoats grama	5
Midway	Shaly Plains	Favorable	950	Alkali sacaton	35
		Normal	550	Western wheatgrass	20
		Unfavorable	300	Blue grama	15
				Sideoats grama	10
				Green needlegrass	5
				Fourwing saltbush	5
				Winterfat	5
26*:					
Kim	Loamy Plains	Favorable	1,600	Blue grama	40
		Normal	1,000	Western wheatgrass	30
		Unfavorable	500	Green needlegrass	10
				Sand dropseed	5
				Needleandthread	5
Pultney	Loamy Plains	Favorable	1,600	Blue grama	30
		Normal	1,000	Western wheatgrass	30
		Unfavorable	500	Green needlegrass	10
				Needleandthread	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
27, 28, 29--------- Manter	Sandy Plains----------	Favorable	2,000	Prairie sandreed----------	25
		Normal	1,600	Blue grama----------	20
		Unfavorable	800	Little bluestem----------	10
				Switchgrass----------	10
				Sideoats grama----------	8
				Sand dropseed----------	5
30---------- Manzanola	Saline Overflow----------	Favorable	2,800	Western wheatgrass----------	30
		Normal	1,400	Alkali sacaton----------	30
		Unfavorable	800	Blue grama----------	20
				Fourwing saltbush----------	5
				Buffalograss----------	3
				Needleandthread----------	3
31---------- Nunn	Clayey Plains----------	Favorable	1,300	Western wheatgrass----------	40
		Normal	950	Blue grama----------	25
		Unfavorable	600	Green needlegrass----------	10
				Fourwing saltbush----------	5
				Buffalograss----------	5
32---------- Olney	Sandy Plains----------	Favorable	2,000	Blue grama----------	25
		Normal	1,500	Prairie sandreed----------	25
		Unfavorable	800	Sideoats grama----------	10
				Needleandthread----------	10
				Sand dropseed----------	5
				Western wheatgrass----------	5
				Sedge----------	5
				Thickspike wheatgrass----------	5
33*:					
Olney----------	Sandy Plains----------	Favorable	2,000	Blue grama----------	25
		Normal	1,500	Prairie sandreed----------	25
		Unfavorable	800	Sideoats grama----------	10
				Needleandthread----------	10
				Sand dropseed----------	5
				Western wheatgrass----------	5
				Sedge----------	5
				Thickspike wheatgrass----------	5
Manzanola---------	Saline Overflow----------	Favorable	2,800	Western wheatgrass----------	30
		Normal	1,400	Alkali sacaton----------	30
		Unfavorable	800	Blue grama----------	20
				Fourwing saltbush----------	5
				Buffalograss----------	3
				Needleandthread----------	3
34*:					
Otero----------	Sandy Plains----------	Favorable	1,800	Blue grama----------	30
		Normal	1,500	Prairie sandreed----------	20
		Unfavorable	1,000	Needlegrass----------	15
				Sideoats grama----------	10
				Little bluestem----------	5
				Sand dropseed----------	5
				Sand sagebrush----------	5
				Indian ricegrass----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
34*:					
Olney	Sandy Plains	Favorable	2,000	Blue grama	25
		Normal	1,500	Prairie sandreed	25
		Unfavorable	800	Sideoats grama	10
				Needleandthread	10
				Sand dropseed	5
				Western wheatgrass	5
				Sedge	5
				Thickspike wheatgrass	5
35	Clayey Plains	Favorable	1,300	Western wheatgrass	40
Razor		Normal	900	Blue grama	20
		Unfavorable	600	Green needlegrass	10
				Fourwing saltbush	5
				Winterfat	5
36*:					
Razor	Clayey Plains	Favorable	1,250	Western wheatgrass	40
		Normal	900	Blue grama	20
		Unfavorable	500	Green needlegrass	10
				Fourwing saltbush	5
				Winterfat	5
Midway	Shaly Plains	Favorable	950	Alkali sacaton	35
		Normal	550	Western wheatgrass	20
		Unfavorable	300	Blue grama	15
				Sideoats grama	10
				Green needlegrass	5
				Fourwing saltbush	5
				Winterfat	5
37	Overflow	Favorable	3,000	Western wheatgrass	35
Sampson		Normal	2,200	Switchgrass	15
		Unfavorable	1,100	Green needlegrass	15
				Big bluestem	10
				Blue grama	5
				Indiangrass	5
				Sideoats grama	5
				Fourwing saltbush	5
38	Loamy Plains	Favorable	1,650	Western wheatgrass	40
Satanta		Normal	1,050	Blue grama	20
		Unfavorable	500	Needleandthread	20
				Green needlegrass	10
				Other perennial forbs	5
39*:					
Satanta	Loamy Plains	Favorable	1,650	Western wheatgrass	40
		Normal	1,050	Blue grama	20
		Unfavorable	500	Needleandthread	20
				Green needlegrass	10
				Other perennial forbs	5
Colby	Loamy Plains	Favorable	1,600	Blue grama	35
		Normal	1,100	Western wheatgrass	25
		Unfavorable	600	Sideoats grama	10
				Green needlegrass	10
				Needleandthread	5
				Buffalograss	5
				Sand dropseed	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
40*:					
Schamber	Gravel Breaks	Favorable	1,200	Blue grama	25
		Normal	800	Little bluestem	15
		Unfavorable	400	Sideoats grama	15
				Needleandthread	10
				Prairie sandreed	5
				Sand dropseed	5
				Indian ricegrass	5
Stoneham	Loamy Slopes	Favorable	1,300	Blue grama	40
		Normal	900	Western wheatgrass	25
		Unfavorable	450	Green needlegrass	15
				Other perennial grasses	5
				Sideoats grama	5
				Sedge	5
41, 42 Stoneham	Loamy Plains	Favorable	1,600	Blue grama	40
		Normal	1,000	Western wheatgrass	25
		Unfavorable	500	Green needlegrass	15
				Buffalograss	5
				Other perennial grasses	5
				Sedge	5
43*:					
Stoneham	Loamy Slopes	Favorable	1,300	Blue grama	40
		Normal	900	Western wheatgrass	25
		Unfavorable	450	Green needlegrass	15
				Other perennial grasses	5
				Sideoats grama	5
				Sedge	5
Kim	Loamy Slopes	Favorable	1,200	Blue grama	35
		Normal	900	Western wheatgrass	30
		Unfavorable	450	Needleandthread	10
				Sideoats grama	5
44*:					
Stoneham	Loamy Plains	Favorable	1,600	Blue grama	40
		Normal	1,000	Western wheatgrass	25
		Unfavorable	500	Green needlegrass	15
				Buffalograss	5
				Other perennial grasses	5
				Sedge	5
Razor	Clayey Plains	Favorable	1,300	Western wheatgrass	40
		Normal	900	Blue grama	20
		Unfavorable	550	Green needlegrass	10
				Fourwing saltbush	5
				Winterfat	5
45 Sundance	Sandy Plains	Favorable	1,800	Prairie sandreed	25
		Normal	1,600	Blue grama	15
		Unfavorable	800	Little bluestem	10
				Sideoats grama	10
				Sand dropseed	5
				Needleandthread	5
				Sand sagebrush	5
				Thickspike wheatgrass	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
46----------	Sandy Plains----------	Favorable	2,500	Prairie sandreed----------	25
Ulm		Normal	1,600	Blue grama----------	20
		Unfavorable	800	Needleandthread----------	10
				Sideoats grama----------	10
				Thickspike wheatgrass---------	7
				Sand bluestem----------	5
				Sand dropseed----------	5
				Sand sagebrush----------	5
				Switchgrass----------	5
47----------	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
Ulm		Normal	1,000	Western wheatgrass----------	30
		Unfavorable	500	Green needlegrass----------	10
				Needleandthread----------	5
				Buffalograss----------	5
				Sedge----------	5
48----------	Deep Sand----------	Favorable	2,500	Prairie sandreed----------	30
Valent		Normal	2,000	Sand bluestem----------	15
		Unfavorable	1,200	Switchgrass----------	15
				Blue grama----------	10
				Needlegrass----------	10
				Little bluestem----------	5
				Sideoats grama----------	5
				Sand sagebrush----------	5
49*:					
Valent----------	Deep Sand----------	Favorable	2,500	Prairie sandreed----------	30
		Normal	2,000	Sand bluestem----------	15
		Unfavorable	1,200	Switchgrass----------	15
				Blue grama----------	10
				Needlegrass----------	10
				Little bluestem----------	5
				Sideoats grama----------	5
				Sand sagebrush----------	5
Vona----------	Sandy Plains----------	Favorable	2,200	Prairie sandreed----------	25
		Normal	1,700	Blue grama----------	20
		Unfavorable	900	Little bluestem----------	10
				Sideoats grama----------	10
				Sand bluestem----------	5
				Sand dropseed----------	5
				Switchgrass----------	5
				Sand sagebrush----------	5
Bijou----------	Sandy Plains----------	Favorable	2,000	Prairie sandreed----------	20
		Normal	1,600	Blue grama----------	15
		Unfavorable	800	Sand bluestem----------	10
				Sand dropseed----------	5
				Sand sagebrush----------	5
				Needleandthread----------	5
				Little bluestem----------	5
				Sideoats grama----------	5
				Thickspike wheatgrass---------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
50---------- Vona	Sandy Plains----------	Favorable	2,200	Prairie sandreed----------	25
		Normal	1,700	Blue grama----------	20
		Unfavorable	900	Little bluestem----------	10
				Sideoats grama----------	10
				Sand bluestem----------	5
				Sand dropseed----------	5
				Switchgrass----------	5
				Sand sagebrush----------	5
51---------- Vona	Sandy Plains----------	Favorable	1,500	Blue grama----------	40
		Normal	1,100	Sideoats grama----------	20
		Unfavorable	600	Sand dropseed----------	10
				Little bluestem----------	5
				Prairie sandreed----------	5
				Sedge----------	5
				Thickspike wheatgrass----------	5
52*:					
Vona----------	Sandy Plains----------	Favorable	2,200	Prairie sandreed----------	25
		Normal	1,700	Blue grama----------	20
		Unfavorable	900	Little bluestem----------	10
				Sideoats grama----------	10
				Sand bluestem----------	5
				Sand dropseed----------	5
				Switchgrass----------	5
				Sand sagebrush----------	5
Olney----------	Sandy Plains----------	Favorable	2,000	Blue grama----------	25
		Normal	1,500	Prairie sandreed----------	25
		Unfavorable	800	Sideoats grama----------	10
				Needleandthread----------	10
				Sand dropseed----------	5
				Western wheatgrass----------	5
				Sedge----------	5
				Thickspike wheatgrass----------	5
53---------- Weld	Loamy Plains----------	Favorable	1,700	Blue grama----------	30
		Normal	1,150	Western wheatgrass----------	30
		Unfavorable	600	Green needlegrass----------	15
				Buffalograss----------	5
				Sedge----------	5
				Needleandthread----------	5
54, 55---------- Wiley	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
		Normal	1,000	Western wheatgrass----------	30
		Unfavorable	600	Green needlegrass----------	10
				Buffalograss----------	5
				Needleandthread----------	5
56*:					
Yoder----------	Sandy Plains----------	Favorable	2,000	Blue grama----------	25
		Normal	1,400	Prairie sandreed----------	20
		Unfavorable	700	Sideoats grama----------	10
				Needleandthread----------	5
				Thickspike wheatgrass----------	5
				Sand dropseed----------	5
				Other shrubs----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
56*:					
Stoneham	Loamy Plains	Favorable	1,600	Blue grama	40
		Normal	1,000	Western wheatgrass	25
		Unfavorable	500	Green needlegrass	15
				Buffalograss	5
				Other perennial grasses	5
				Sedge	5
57*:					
Yoder	Sandy Plains	Favorable	2,000	Blue grama	25
		Normal	1,400	Prairie sandreed	20
		Unfavorable	700	Sideoats grama	10
				Needleandthread	5
				Thickspike wheatgrass	5
				Sand dropseed	5
				Other shrubs	5
Vona	Sandy Plains	Favorable	2,200	Prairie sandreed	25
		Normal	1,700	Blue grama	20
		Unfavorable	900	Little bluestem	10
				Sideoats grama	10
				Sand bluestem	5
				Sand dropseed	5
				Switchgrass	5
				Sand sagebrush	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1 Apishapa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
2*:					
Arvada	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight	Severe: excess salt, excess sodium.
Deertrail	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.	Severe: excess sodium.
3 Ascalon	Slight	Slight	Slight	Slight	Moderate: droughty.
4 Ascalon	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
5*:					
Ascalon	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Eckley	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: droughty, slope.
6 Baca	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
7 Bijou	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
8 Colby	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Slight	Slight.
9 Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
10*:					
Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Satanta	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.	Slight.
11 Firstview	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Moderate: droughty.
12 Fluvaquents	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
13--Fort Collins	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
14*:					
Fort Collins	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
Vona	Slight	Slight	Slight	Slight	Moderate: droughty.
15*:					
Glenberg	Severe: flooding.	Slight	Moderate: small stones.	Slight	Moderate: droughty.
Bankard	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: droughty, flooding.
16--Goshen	Severe: flooding.	Slight	Slight	Slight	Slight.
17--Haverson	Severe: flooding.	Moderate: dusty.	Slight	Moderate: dusty.	Moderate: flooding.
18--Heldt	Severe: flooding.	Slight	Slight	Slight	Slight.
19*:					
Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
Richfield	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
20*:					
Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
Ulysses	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
21--Kim	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.	Slight.
22--Kim	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.	Slight.
23*:					
Kim	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.	Slight.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: dusty.	Severe: depth to rock.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
24*:					
Kim	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope.
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: slope, dusty.	Severe: slope, depth to rock.
25*:					
Kim	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope.
Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Slight	Severe: thin layer.
26*:					
Kim	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.	Slight.
Pultney	Moderate: dusty, excess salt.	Moderate: excess salt, dusty.	Moderate: slope, depth to rock, excess salt.	Moderate: dusty.	Moderate: excess salt, depth to rock.
27, 28--- Manter	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
29--- Manter	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
30--- Manzanola	Slight	Slight	Moderate: small stones.	Slight	Slight.
31--- Nunn	Slight	Slight	Slight	Slight	Slight.
32--- Olney	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
33*:					
Olney	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Manzanola	Slight	Slight	Moderate: small stones.	Slight	Slight.
34*:					
Otero	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
Olney	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
35--Razor	Slight	Slight	Moderate: slope.	Slight	Slight.
36*:					
Razor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Slight	Severe: thin layer.
37--Sampson	Severe: flooding.	Slight	Slight	Slight	Slight.
38--Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
39*:					
Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
Colby	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Slight	Slight.
40*:					
Schamber	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.	Severe: small stones, droughty, slope.
Stoneham	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.
41--Stoneham	Moderate: dusty.	Moderate: dusty.	Moderate: small stones, dusty.	Moderate: dusty.	Slight.
42--Stoneham	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.	Slight.
43*:					
Stoneham	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope.
Kim	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope.
44*:					
Stoneham	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
44*: Razor	Slight	Slight	Moderate: slope.	Slight	Slight.
45 Sundance	Slight	Slight	Slight	Slight	Slight.
46 Ulm	Slight	Slight	Moderate: small stones.	Slight	Slight.
47 Ulm	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
48 Valent	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
49*: Valent	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Vona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, droughty.
Bijou	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
50 Vona	Slight	Slight	Slight	Slight	Moderate: droughty.
51 Vona	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty, slope.
52*: Vona	Slight	Slight	Severe: slope.	Slight	Moderate: droughty, slope.
Olney	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
53 Weld	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
54 Wiley	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
55 Wiley	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
56*: Yoder	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
56*:					
Stoneham	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.	Slight.
57*:					
Yoder	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Vona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements					Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Shallow water areas	Openland wildlife	Rangeland wildlife
1---------- Apishapa	Very poor	Very poor	Poor	Poor	Good	Very poor	Poor.
2*:							
Arvada----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Poor.
Deertrail---------	Poor	Poor	Fair	Poor	Very poor	Poor	Poor.
3, 4---------- Ascalon	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
5*:							
Ascalon----------	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Eckley----------	Poor	Poor	Fair	Fair	Very poor	Poor	Fair.
6---------- Baca	Poor	Good	Fair	Poor	Very poor	Fair	Poor.
7---------- Bijou	Fair	Good	Fair	Fair	Very poor	Fair	Fair.
8---------- Colby	Fair	Good	Fair	Poor	Poor	Fair	Fair.
9---------- Colby	Poor	Fair	Fair	Poor	Very poor	Fair	Poor.
10*:							
Colby----------	Poor	Fair	Fair	Poor	Very poor	Fair	Poor.
Satanta----------	Fair	Good	Fair	Fair	Very poor	Fair	Fair.
11---------- Firstvie	Poor	Poor	Fair	Fair	Very poor	Poor	Fair.
12---------- Fluvaquents	Poor	Poor	Fair	Poor	Fair	Poor	Poor.
13---------- Fort Collins	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
14*:							
Fort Collins------	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
Vona----------	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
15*:							
Glenberg----------	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Bankard----------	Poor	Poor	Fair	Poor	Very poor	Poor	Poor.
16---------- Goshen	Good	Good	Good	Good	Very poor	Good	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements					Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Shallow water areas	Openland wildlife	Rangeland wildlife
17---------- Haverson	Fair	Good	Fair	Fair	Very poor	Good	Fair.
18---------- Heldt	Fair	Fair	Poor	Poor	Poor	Fair	Fair.
19*:							
Keith----------	Good	Good	Fair	Fair	Very poor	Good	Fair.
Richfield---------	Fair	Good	Fair	Poor	Very poor	Fair	Fair.
20*:							
Keith----------	Good	Good	Fair	Fair	Very poor	Good	Fair.
Ulysses----------	Fair	Good	Fair	Poor	Fair	Fair	Fair.
21---------- Kim	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
22---------- Kim	Poor	Poor	Fair	Fair	Very poor	Poor	Fair.
23*:							
Kim----------	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Canyon----------	Poor	Poor	Fair	Poor	Very poor	Poor	Poor.
24*:							
Kim----------	Poor	Poor	Fair	Fair	Very poor	Poor	Fair.
Canyon----------	Poor	Poor	Fair	Poor	Very poor	Poor	Poor.
25*:							
Kim----------	Poor	Poor	Fair	Fair	Very poor	Poor	Fair.
Midway----------	Very poor	Very poor	Fair	Fair	Very poor	Poor	Fair.
26*:							
Kim----------	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Pultney----------	Poor	Poor	Fair	Fair	Very poor	Poor	Fair.
27, 28---------- Manter	Fair	Good	Fair	Fair	Very poor	Fair	Fair.
29---------- Manter	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
30---------- Manzanola	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
31---------- Nunn	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
32---------- Olney	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
33*:							
Olney----------	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements					Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Shallow water areas	Openland wildlife	Rangeland wildlife
33*:							
Manzanola	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
34*:							
Otero	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Olney	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
35---Razor	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
36*:							
Razor	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
Midway	Very poor	Very poor	Fair	Fair	Very poor	Poor	Fair.
37---Sampson	Fair	Fair	Fair	Poor	Very poor	Fair	Fair.
38---Satanta	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
39*:							
Satanta	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
Colby	Fair	Good	Fair	Poor	Poor	Fair	Fair.
40*:							
Schamber	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Poor.
Stoneham	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
41, 42---Stoneham	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
43*:							
Stoneham	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Kim	Poor	Poor	Fair	Fair	Very poor	Poor	Fair.
44*:							
Stoneham	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Razor	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
45---Sundance	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
46---Ulm	Poor	Fair	Fair	Poor	Very poor	Fair	Fair.
47---Ulm	Fair	Good	Fair	Fair	Very poor	Fair	Fair.
48---Valent	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements					Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Shallow water areas	Openland wildlife	Rangeland wildlife
49*:							
Valent	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
Vona	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
Bijou	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
50---------- Vona	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
51---------- Vona	Poor	Poor	Fair	Fair	Very poor	Fair	Fair.
52*:							
Vona	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.
Olney	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
53---------- Weld	Fair	Fair	Fair	Poor	Very poor	Fair	Poor.
54, 55---------- Wiley	Poor	Fair	Fair	Poor	Very poor	Fair	Poor.
56*:							
Yoder	Poor	Poor	Fair	Fair	Very poor	Fair	Fair.
Stoneham	Poor	Fair	Fair	Fair	Very poor	Fair	Fair.
57*:							
Yoder	Poor	Poor	Fair	Fair	Very poor	Fair	Fair.
Vona	Fair	Fair	Fair	Fair	Very poor	Fair	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1 Apishapa	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding.	Severe: ponding.
2*: Arvada	Moderate: too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Severe: excess salt, excess sodium.
Deertrail	Moderate: too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, shrink-swell.	Severe: excess sodium.
3 Ascalon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
4 Ascalon	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
5*: Ascalon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Eckley	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
6 Baca	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
7 Bijou	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
8 Colby	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
9 Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
10*: Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
11 Firstview	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: droughty.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
12---------- Fluvaquents	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
13---------- Fort Collins	Slight---------	Slight--------	Slight--------	Slight--------	Slight---------	Slight.
14*:						
Fort Collins-----	Slight---------	Slight--------	Slight--------	Slight--------	Slight---------	Slight.
Vona----------	Severe: cutbanks cave.	Slight--------	Slight--------	Slight--------	Slight---------	Slight.
15*:						
Glenberg---------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
Bankard----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
16---------- Goshen	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
17---------- Haverson	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
18---------- Heldt	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Slight.
19*:						
Keith----------	Slight---------	Moderate: shrink-swell.	Slight--------	Moderate: shrink-swell.	Severe: low strength.	Slight.
Richfield--------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
20*:						
Keith----------	Slight---------	Moderate: shrink-swell.	Slight--------	Moderate: shrink-swell.	Severe: low strength.	Slight.
Ulysses----------	Slight---------	Moderate: shrink-swell.	Slight--------	Moderate: shrink-swell.	Severe: low strength.	Slight.
21---------- Kim	Slight---------	Slight--------	Slight--------	Slight--------	Slight---------	Slight.
22---------- Kim	Slight---------	Slight--------	Slight--------	Moderate: slope.	Slight---------	Slight.
23*:						
Kim----------	Slight---------	Slight--------	Slight--------	Slight--------	Slight---------	Slight.
Canyon----------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
24*:						
Kim	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
25*:						
Kim	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: thin layer.
26*:						
Kim	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
Pultney	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: excess salt, depth to rock.
27--- Manter	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
28--- Manter	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
29--- Manter	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
30--- Manzanola	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
31--- Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
32--- Olney	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
33*:						
Olney	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Manzanola	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
34*:						
Otero	Slight	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
34*:						
Olney	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
35	Moderate:	Severe:	Severe:	Severe:	Severe:	Slight.
Razor	depth to rock, too clayey.	shrink-swell.	shrink-swell.	shrink-swell.	low strength, shrink-swell.	
36*:						
Razor	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: thin layer.
37	Slight	Severe:	Severe:	Severe:	Moderate:	Slight.
Sampson		flooding.	flooding.	flooding.	low strength, flooding, frost action.	
38	Slight	Slight	Slight	Slight	Moderate:	Slight.
Satanta					frost action.	
39*:						
Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Colby	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
40*:						
Schamber	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
Stoneham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
41	Slight	Moderate:	Moderate:	Moderate:	Moderate:	Slight.
Stoneham		shrink-swell.	shrink-swell.	shrink-swell.	low strength, shrink-swell.	
42	Slight	Moderate:	Moderate:	Moderate:	Moderate:	Slight.
Stoneham		shrink-swell.	shrink-swell.	shrink-swell, slope.	low strength, shrink-swell.	
43*:						
Stoneham	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope.
Kim	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
44*:						
Stoneham	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Slight.
Razor	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
45--- Sundance	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
46, 47--- Ulm	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
48--- Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
49*:						
Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Vona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Bijou	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
50--- Vona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
51--- Vona	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
52*:						
Vona	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Olney	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
53--- Weld	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength, frost action.	Slight.
54--- Wiley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
55--- Wiley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
56*:						
Yoder	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
56*:						
Stoneham	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
57*:						
Yoder	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Vona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Apishapa	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
2*: Arvada	Severe: percs slowly.	Moderate: seepage, too clayey.	Severe: excess salt.	Moderate: flooding.	Poor. too clayey, hard to pack, excess salt.
Deertrail	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
3, 4 Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
5*: Ascalon	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
Eckley	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
6 Baca	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
7 Bijou	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
8 Colby	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
9 Colby	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
10*: Colby	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
11 Firstview	Severe: percs slowly.	Severe: seepage.	Severe: too clayey, excess salt.	Severe: seepage.	Poor: too clayey, hard to pack, excess salt.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12--Fluvaquents	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
13--Fort Collins	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
14*:					
Fort Collins	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Vona	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
15*:					
Glenberg	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
16--Goshen	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Good.
17--Haverson	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
18--Heldt	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Poor: hard to pack.
19*:					
Keith	Slight	Moderate: seepage.	Slight	Slight	Good.
Richfield	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
20*:					
Keith	Slight	Moderate: seepage.	Slight	Slight	Good.
Ulysses	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
21--Kim	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
22--Kim	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Fair: small stones.
23*:					
Kim	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
23*:					
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, small stones.
24*:					
Kim	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
25*:					
Kim	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Midway	Severe: depth to rock, low strength.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
26*:					
Kim	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
Pultney	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
27, 28 Manter	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
29 Manter	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
30 Manzanola	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
31 Nunn	Severe: percs slowly.	Slight	Severe: seepage, too clayey.	Slight	Poor: too clayey, hard to pack.
32 Olney	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
33*:					
Olney	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
Manzanola	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
34*:					
Otero	Slight	Severe: seepage.	Slight	Slight	Fair: small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
34*:					
Olney	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
35	Severe:	Severe:	Severe:	Severe:	Poor:
Razor	depth to rock, percs slowly.	depth to rock.	depth to rock, excess salt.	depth to rock.	depth to rock, hard to pack.
36*:					
Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
Midway	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
37	Moderate:	Severe:	Moderate:	Moderate:	Fair:
Sampson	flooding, percs slowly.	flooding.	flooding, too clayey.	flooding.	too clayey.
38	Slight	Moderate:	Moderate:	Slight	Fair:
Satanta		seepage.	too clayey.		too clayey.
39*:					
Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Colby	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
40*:					
Schamber	Severe: slope, poor filter.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: small stones, seepage, too sandy.
Stoneham	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
41, 42	Moderate:	Severe:	Slight	Slight	Good.
Stoneham	percs slowly.	seepage.			
43*:					
Stoneham	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Kim	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
44*:					
Stoneham	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Good.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
44*:					
Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
45 Sundance	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
46 Ulm	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
47 Ulm	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: small stones.
48 Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Slight	Poor: too sandy.
49*:					
Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: too sandy.
Vona	Severe: poor filter.	Severe: seepage, slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: too sandy, slope.
Bijou	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy.
50, 51 Vona	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
52*:					
Vona	Severe: poor filter.	Severe: seepage, slope.	Moderate: too sandy.	Slight	Fair: too sandy.
Olney	Slight	Severe: seepage, slope.	Moderate: too sandy.	Slight	Fair: too sandy.
53 Weld	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
54 Wiley	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
55 Wiley	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
56*:					
Yoder	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Slight	Poor: seepage, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
56*:					
Stoneham	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Good.
57*:					
Yoder	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.
Vona	Severe: poor filter.	Severe: seepage, slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: too sandy, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1---- Apishapa	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
2*:				
Arvada----	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Deertrail----	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
3, 4---- Ascalon	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
5*:				
Ascalon----	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Eckley----	Good----	Probable----	Probable----	Poor: small stones, area reclaim.
6---- Baca	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
7---- Bijou	Good----	Probable----	Improbable: too sandy.	Fair: too sandy, small stones, thin layer.
8---- Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
9---- Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
10*:				
Colby----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Satanta----	Good----	Improbable: excess fines.	Improbable: excess fines.	Good.
11---- Firstview	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
12--Fluvaquents	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
13--Fort Collins	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
14*:				
Fort Collins	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Vona	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
15*:				
Glenberg	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bankard	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
16--Goshen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
17--Haverson	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
18--Heldt	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
19*:				
Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Richfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
20*:				
Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ulysses	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
21, 22--Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
23*:				
Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
24*:				
Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
24*:				
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
25*:				
Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Midway	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
26*:				
Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Pultney	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
27, 28--Manter	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
29--Manter	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
30--Manzanola	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
31--Nunn	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
32--Olney	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
33*:				
Olney	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Manzanola	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
34*:				
Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Olney	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
35--Razor	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
36*:				
Razor	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
Midway	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
37--- Sampson	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
38--- Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
39*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
40*:				
Schamber	Fair: slope.	Probable	Probable	Poor: slope, small stones, area reclaim.
Stoneham	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
41, 42--- Stoneham	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
43*:				
Stoneham	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
44*:				
Stoneham	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Razor	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
45--- Sundance	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
46--- Ulm	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
47--Ulm	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
48--Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy.
49*:				
Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
Vona	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
Bijou	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones, thin layer.
50, 51--Vona	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
52*:				
Vona	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Olney	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
53--Weld	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
54, 55--Wiley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
56*:				
Yoder	Good	Probable	Probable	Poor: small stones, area reclaim.
Stoneham	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
57*:				
Yoder	Fair: slope.	Probable	Probable	Poor: small stones, slope.
Vona	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1---------- Apishapa	Slight--------	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
2*: Arvada----------	Moderate: seepage.	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly.	Erodes easily	Too arid, excess salt, excess sodium.
Deertrail--------	Slight--------	Severe: piping, excess sodium.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Excess sodium, erodes easily, percs slowly.
3---------- Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
4---------- Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
5*: Ascalon----------	Severe: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
Eckley----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
6---------- Baca	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
7---------- Bijou	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
8---------- Colby	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
9---------- Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
10*: Colby----------	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Satanta----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
11---------- Firstview	Moderate: seepage.	Severe: excess salt.	Deep to water	Droughty, soil blowing.	Soil blowing, percs slowly.	Droughty, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
12---------- Fluvaquents	Severe: seepage.	Severe: seepage, wetness.	Flooding, large stones, frost action.	Wetness, droughty.	Large stones, wetness.	Large stones, wetness.
13---------- Fort Collins	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
14*:						
Fort Collins-----	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
Vona----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
15*:						
Glenberg---------	Severe: seepage.	Severe: piping.	Deep to water	Droughty-------	Too sandy, soil blowing.	Droughty.
Bankard----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
16---------- Goshen	Moderate: seepage.	Severe: thin layer.	Deep to water	Favorable------	Erodes easily	Erodes easily.
17---------- Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
18---------- Heldt	Slight--------	Moderate: hard to pack.	Deep to water	Percs slowly, excess salt.	Percs slowly---	Excess salt, percs slowly.
19*:						
Keith----------	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Richfield--------	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
20*:						
Keith----------	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Ulysses----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
21---------- Kim	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Too arid.
22---------- Kim	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Too arid.
23*:						
Kim----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Too arid.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
23*:						
Canyon	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
24*:						
Kim	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Too arid, slope.
Canyon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
25*:						
Kim	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Too arid, slope.
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
26*:						
Kim	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Too arid.
Pultney	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Excess salt, depth to rock.
27, 28 Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
29 Manter	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Soil blowing	Slope, too sandy, soil blowing.	Slope.
30 Manzanola	Moderate: seepage.	Moderate: thin layer.	Deep to water	Percs slowly, excess salt.	Percs slowly	Percs slowly.
31 Nunn	Slight	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
32 Olney	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
33*:						
Olney	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
Manzanola	Moderate: seepage.	Moderate: thin layer.	Deep to water	Percs slowly, excess salt.	Percs slowly	Percs slowly.
34*:						
Otero	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Soil blowing	Droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
34*:						
Olney	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
35--- Razor	Moderate: depth to rock, slope.	Moderate: excess salt.	Deep to water	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
36*:						
Razor	Severe: slope.	Moderate: excess salt.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
37--- Sampson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
38--- Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
39*:						
Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Colby	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
40*:						
Schamber	Severe: slope, seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Stoneham	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope	Slope	Slope.
41--- Stoneham	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Favorable	Favorable.
42--- Stoneham	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope	Favorable	Favorable.
43*:						
Stoneham	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope	Slope	Slope.
Kim	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Too arid, slope.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
44*:						
Stoneham	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope	Favorable	Favorable.
Razor	Moderate: depth to rock, slope.	Moderate: excess salt.	Deep to water	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
45--- Sundance	Moderate: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
46--- Ulm	Moderate: seepage.	Slight	Deep to water	Fast intake, soil blowing, percs slowly.	Erodes easily, soil blowing.	Erodes easily, percs slowly.
47--- Ulm	Moderate: seepage.	Slight	Deep to water	Percs slowly	Erodes slowly	Erodes easily, percs slowly.
48--- Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
49*:						
Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Vona	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope.
Bijou	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
50--- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
51--- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing, slope.	Too sandy, soil blowing.	Favorable.
52*:						
Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing, slope.	Too sandy, soil blowing.	Favorable.
Olney	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
53--- Weld	Moderate: seepage.	Severe: piping.	Deep to water	Percs slowly	Favorable	Too arid, percs slowly.
54--- Wiley	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Too arid, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
55---------- Wiley	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Too arid, erodes easily.
56*:						
Yoder----------	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
Stoneham----------	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope----------	Favorable------	Favorable.
57*:						
Yoder----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Vona----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
1----------	0-4	Clay loam--------	CL	A-6, A-7	0	100	100	80-95	70-80	30-45	15-25
Apishapa	4-60	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	80-100	70-90	35-55	15-35
2*:											
Arvada----------	0-2	Clay loam--------	CL-ML, CL	A-4, A-6	0	80-100	75-100	70-100	50-85	20-30	5-15
	2-15	Clay, clay loam, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	95-100	75-100	75-100	60-95	35-60	15-40
	15-60	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	85-100	80-100	70-95	60-90	25-50	10-25
Deertrail-------	0-2	Loam------------	CL-ML	A-4	0	100	90-100	80-95	60-75	20-30	5-10
	2-7	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	75-90	30-50	10-25
	7-25	Clay, clay loam, silty clay loam.	CL	A-7	0	100	100	90-100	75-90	40-60	15-35
	25-60	Silt loam, silty clay loam, clay loam.	CL-ML, CL	A-6, A-4	0	100	100	85-100	70-90	20-35	5-15
3, 4----------	0-6	Sandy loam-------	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
Ascalon	6-19	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	19-35	Sandy clay loam, loam, sandy loam.	SC, SM, CL	A-4, A-6	0	95-100	95-100	75-95	40-65	20-40	NP-15
	35-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
5*:											
Ascalon----------	0-6	Sandy loam-------	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	6-19	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	19-35	Sandy clay loam, loam, sandy loam.	SC, SM, CL	A-4, A-6	0	95-100	95-100	75-95	40-65	20-40	NP-15
	35-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
Eckley----------	0-4	Gravelly sandy loam.	SM, SM-SC	A-2, A-4	0	75-85	65-75	50-60	25-40	20-30	NP-10
	4-16	Gravelly sandy clay loam, very gravelly sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	65-95	50-90	30-75	20-65	30-40	10-20
	16-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
6----------	0-6	Silt loam--------	CL-ML	A-4	0	100	100	85-95	70-90	20-30	5-10
Baca	6-19	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0	100	100	90-100	75-95	35-45	15-25
	19-60	Loam, silt loam, silty clay loam.	CL-ML	A-4	0	100	100	85-95	70-90	25-30	5-10
7----------	0-5	Loamy sand-------	SM	A-2, A-1	0	85-100	80-100	40-85	15-30	---	NP
Bijou	5-13	Coarse sandy loam, sandy loam.	SM-SC, SM	A-2, A-4	0	90-100	90-100	35-80	25-40	15-25	NP-10
	13-60	Loamy coarse sand, loamy sand, sand.	SM, SP-SM	A-1, A-2, A-3	0	90-100	90-100	30-70	5-30	---	NP
8, 9----------	0-3	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	75-100	25-40	3-15
Colby	3-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
10*:											
Colby----------	0-3	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	75-100	25-40	3-15
	3-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Satanta---------	0-8	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	8-21	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	21-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
11----------	0-6	Sandy loam-------	SM	A-2, A-4	0	95-100	90-100	60-90	15-45	---	NP
Firstview	6-13	Sandy loam-------	SM	A-2, A-4	0	95-100	90-100	60-90	30-45	20-25	NP-5
	13-27	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	90-100	60-90	40-65	25-40	10-20
	27-58	Clay, clay loam	CL, CH	A-7	0	95-100	90-100	80-100	60-90	40-60	20-35
	58-60	Sandy clay loam, clay loam, clay.	CL, CH, SC	A-7, A-6	0	90-100	80-100	60-100	35-90	25-60	10-35
12----------	0-10	Variable---------	SM, ML, CL, SC	A-2, A-4, A-6	0-10	90-95	85-95	55-65	20-60	15-30	NP-15
Fluvaquents	10-60	Stratified clay to gravelly sand.	SM, ML, CL, CL-ML	A-2, A-4, A-6	0-20	65-85	60-80	45-70	30-60	25-35	NP-15
13----------	0-5	Loam-------------	ML	A-4	0	95-100	90-100	85-100	50-65	20-30	NP-5
Fort Collins	5-28	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	60-75	25-40	10-20
	28-60	Loam, silt loam, fine sandy loam.	CL-ML, ML	A-4	0	95-100	90-100	80-95	50-75	20-30	NP-10
14*:											
Fort Collins----	0-5	Loam-------------	ML	A-4	0	95-100	90-100	85-100	50-65	20-30	NP-5
	5-28	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	60-75	25-40	10-20
	28-60	Loam, silt loam, fine sandy loam.	CL-ML, ML	A-4	0	95-100	90-100	80-95	50-75	20-30	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
14*:											
Vona	0-4	Loamy sand	SM	A-2	0	100	90-100	60-90	15-30	---	NP
	4-20	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	90-100	60-90	30-45	20-30	NP-10
	20-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	15-25	NP-5
15*:											
Glenberg	0-10	Sandy loam	SM	A-4, A-2	0	95-100	85-100	60-100	30-45	---	NP
	10-60	Stratified loamy sand to clay loam.	SM	A-2, A-4	0	90-100	75-100	50-100	25-40	---	NP
Bankard	0-10	Loamy sand	SM	A-2	0	95-100	90-100	50-90	15-35	---	NP
	10-60	Stratified loamy fine sand to sand.	SM, SP-SM	A-2	0	95-100	75-100	60-80	10-25	---	NP
16 Goshen	0-4	Silt loam	CL, CL-ML, ML	A-4, A-6	0	100	95-100	90-100	70-95	20-40	3-20
	4-21	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	100	90-100	65-95	25-40	8-22
	21-60	Silt loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	20-35	4-15
17 Haverson	0-14	Loam	ML	A-4	0	95-100	90-100	85-100	55-90	25-35	NP-10
	14-60	Stratified clay loam to sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-70	25-40	5-15
18 Heldt	0-5	Clay loam	CL	A-6	0	95-100	95-100	95-100	75-95	30-40	15-25
	5-60	Clay, silty clay, clay loam.	CH, CL	A-7	0	95-100	95-100	95-100	75-95	45-55	30-40
19*:											
Keith	0-6	Silt loam	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	6-25	Silt loam, silty clay loam, loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	25-60	Silt loam, loam	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12
Richfield	0-6	Silt loam	CL-ML, CL, ML	A-4, A-6	0	100	100	90-100	70-100	20-35	2-15
	6-24	Silty clay loam, silty clay.	CL, CH	A-7-6	0	100	100	95-100	90-100	40-60	20-35
	24-60	Silty clay loam, silt loam, loam	CL-ML, CL	A-4, A-6, A-7-6	0	100	100	95-100	75-100	25-45	5-20
20*:											
Keith	0-6	Silt loam	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	6-25	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	25-60	Silt loam, loam	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
20*:											
Ulysses	0-8	Silt loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	8-31	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-100	25-43	11-20
	31-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
21, 22	0-7	Loam	ML, CL-ML	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
Kim	7-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
23*, 24*:											
Kim	0-7	Loam	ML, CL-ML	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
	7-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
Canyon	0-3	Loam	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	3-13	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	13	Weathered bedrock	---	---	---	---	---	---	---	---	---
25*:											
Kim	0-7	Loam	ML, CL-ML	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
	7-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
Midway	0-2	Clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	2-13	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	13	Weathered bedrock	---	---	---	---	---	---	---	---	---
26*:											
Kim	0-7	Loam	ML, CL-ML	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
	7-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
Pultney	0-4	Very fine sandy loam.	CL-ML	A-4	0	95-100	95-100	80-90	60-80	25-30	5-10
	4-30	Clay loam, loam	CL	A-6	0	95-100	90-100	85-100	65-85	30-40	10-15
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
27, 28, 29	0-4	Sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0	95-100	75-100	45-85	25-55	20-30	NP-10
Manter	4-20	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-10
	20-60	Sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
30	0-5	Clay loam	CL	A-6	0-5	95-100	85-100	80-100	75-95	30-40	15-25
Manzanola	5-26	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-90	35-50	20-30
	26-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	80-95	60-90	30-40	15-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
31----------	0-9	Clay loam--------	CL	A-6	0-5	95-100	90-100	80-90	65-85	30-40	15-25
Nunn	9-27	Clay loam, clay	CL, CH	A-7	0-5	95-100	90-100	85-95	65-75	40-60	25-40
	27-60	Clay loam, loam, gravelly sandy clay.	CL, SC	A-6	0-5	80-100	60-100	60-90	35-75	30-40	15-25
32----------	0-4	Sandy loam-------	SM	A-2	0	95-100	90-100	70-95	20-35	15-25	NP-5
Olney	4-14	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	14-18	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-55	20-35	5-15
	18-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	15-25	NP-5
33*:											
Olney----------	0-4	Sandy loam-------	SM	A-2	0	95-100	90-100	70-95	20-35	15-25	NP-5
	4-14	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	14-18	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-55	20-35	5-15
	18-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	15-25	NP-5
Manzanola-------	0-5	Clay loam--------	CL	A-6	0-5	95-100	85-100	80-100	75-95	30-40	15-25
	5-21	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-90	35-50	20-30
	21-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	80-95	60-90	30-40	15-25
34*:											
Otero----------	0-5	Sandy loam-------	SM	A-2	0-1	95-100	75-100	50-80	25-35	20-25	NP-5
	5-60	Sandy loam, fine sandy loam.	SM	A-2	0-1	90-100	75-100	40-80	25-35	15-25	NP-5
Olney----------	0-4	Sandy loam-------	SM	A-2	0	95-100	90-100	70-95	20-35	15-25	NP-5
	4-14	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	14-18	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-55	20-35	5-15
	18-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	15-25	NP-5
35----------	0-2	Clay loam--------	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
Razor	2-11	Silty clay, clay, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	11-30	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
36*:											
Razor	0-2	Clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
	2-11	Silty clay, clay, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	11-30	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
Midway	0-2	Clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	2-13	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	13	Weathered bedrock	---	---	---	---	---	---	---	---	---
37	0-5	Loam	CL-ML	A-4	0	95-100	90-100	75-95	55-70	20-30	5-10
Sampson	5-30	Loam, clay loam	CL	A-6	0	85-100	80-100	65-90	50-75	25-40	10-20
	30-78	Loam, clay loam, sandy clay loam.	CL-ML, SM-SC, ML, SM	A-4	0	85-100	80-100	60-90	35-70	20-30	NP-10
38	0-8	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
Satanta	8-21	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	21-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
39*:											
Satanta	0-8	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	8-21	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	21-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Colby	0-3	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	75-100	25-40	3-15
	3-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
40*:											
Schamber	0-10	Very gravelly sandy loam.	SM, SW-SM, GM, GW-GM	A-2, A-1	0-5	55-90	50-75	40-60	10-35	<25	NP-5
	10-60	Very gravelly sand, very gravelly loamy sand.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-80	25-50	5-20	0-10	<25	NP-5
Stoneham	0-3	Loam	CL-ML	A-4	0	80-100	75-100	65-95	60-75	25-30	5-10
	3-7	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	80-100	35-80	25-35	10-20
	7-60	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	75-100	60-95	45-75	25-35	10-20
41, 42	0-3	Loam	CL-ML	A-4	0	80-100	75-100	65-95	60-75	25-30	5-10
Stoneham	3-7	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	80-100	35-80	25-35	10-20
	7-60	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	75-100	60-95	45-75	25-35	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
43*:											
Stoneham	0-3	Loam	CL-ML	A-4	0	80-100	75-100	65-95	60-75	25-30	5-10
	3-7	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	80-100	35-80	25-35	10-20
	7-60	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	75-100	60-95	45-75	25-35	10-20
Kim	0-7	Loam	ML, CL-ML	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
	7-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
44*:											
Stoneham	0-3	Loam	CL-ML	A-4	0	80-100	75-100	65-95	60-75	25-30	5-10
	3-7	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	80-100	35-80	25-35	10-20
	7-60	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	75-100	60-95	45-75	25-35	10-20
Razor	0-2	Clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
	2-11	Silty clay, clay, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	11-30	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
45	0-8	Loamy sand	SM	A-2	0	95-100	90-100	55-80	15-30	---	NP
Sundance	8-16	Sandy loam, sandy clay loam.	SM-SC, CL-ML	A-4	0	95-100	90-100	60-80	35-55	20-30	5-10
	16-50	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-85	25-40	10-20
	50-60	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-40	5-15
46	0-10	Loamy sand	SM	A-2	0	90-100	75-100	50-75	15-30	---	NP
Ulm	10-25	Clay loam, clay	CL	A-6, A-7	0	75-100	75-100	75-100	60-80	35-45	20-30
	25-46	Clay, sandy clay, clay loam.	SC, CL	A-6	0	75-100	75-100	75-100	35-60	25-40	15-25
	46-60	Sandy clay loam, clay loam.	SC, CL	A-6	0	75-100	75-100	60-80	35-60	25-40	10-20
47	0-3	Loam	CL-ML	A-4	0-5	95-100	95-100	80-100	70-80	20-30	5-10
Ulm	3-19	Clay loam, clay	CL	A-6, A-7	0-5	75-100	75-100	75-100	60-80	35-45	20-30
	19-30	Clay loam, clay	CL	A-6	0-5	75-100	75-100	75-100	60-80	30-40	15-20
	30-60	Sandy clay loam, loam.	CL, SC	A-6	0-5	75-100	75-100	70-90	40-55	30-40	10-20
48	0-16	Loamy sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	---	NP
Valent	16-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
49*:											
Valent	0-16	Loamy sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	---	NP
	16-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
49*:											
Vona	0-4	Loamy sand	SM	A-2	0	100	90-100	60-90	15-30	---	NP
	4-20	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	90-100	60-90	30-45	20-30	NP-10
	20-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	15-25	NP-5
Bijou	0-5	Loamy sand	SM	A-2, A-1	0	85-100	80-100	40-85	15-30	---	NP
	5-13	Coarse sandy loam, sandy loam.	SM-SC, SM	A-2, A-4	0	90-100	90-100	35-80	25-40	15-25	NP-10
	13-60	Loamy coarse sand, loamy sand, sand.	SM, SP-SM	A-1, A-2, A-3	0	90-100	90-100	30-70	5-30	---	NP
50, 51 Vona	0-4	Loamy sand	SM	A-2	0	100	90-100	60-90	15-30	---	NP
	4-20	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	90-100	60-90	30-45	20-30	NP-10
	20-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	15-25	NP-5
52*:											
Vona	0-4	Loamy sand	SM	A-2	0	100	90-100	60-90	15-30	---	NP
	4-20	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	90-100	60-90	30-45	20-30	NP-10
	20-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	15-25	NP-5
Olney	0-4	Sandy loam	SM	A-2	0	95-100	90-100	70-95	20-35	15-25	NP-5
	4-14	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	14-18	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-55	20-35	5-15
	18-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	15-25	NP-5
53 Weld	0-3	Silt loam	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
	3-21	Silty clay loam, silty clay, clay.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	15-30
	21-60	Silt loam, loam	ML, CL-ML	A-4, A-6	0	100	95-100	80-100	70-95	20-35	5-15
54, 55 Wiley	0-3	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	3-23	Silty clay loam, silt loam, clay loam.	CL	A-6	0	100	100	90-100	70-95	25-35	10-20
	23-60	Silt loam, very fine sandy loam, loam.	CL, CL-ML	A-6, A-4	0	100	100	90-100	70-95	25-35	5-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
56*:											
Yoder	0-4	Sandy loam	SM	A-2, A-4	0-5	80-100	75-90	40-80	15-45	20-25	NP-5
	4-17	Coarse sandy loam, gravelly sandy loam, sandy clay loam.	SM-SC, GM-GC	A-1, A-2, A-4	0-5	55-100	50-90	30-60	20-45	20-30	5-10
	17-60	Gravelly loamy sand, gravelly sand.	SP-SM, SM	A-1, A-2	0-5	65-100	50-80	30-60	5-30	---	NP
Stoneham	0-3	Loam	CL-ML	A-4	0	80-100	75-100	65-95	60-75	25-30	5-10
	3-7	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	80-100	35-80	25-35	10-20
	7-60	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	75-100	60-95	45-75	25-35	10-20
57*:											
Yoder	0-4	Sandy loam	SM	A-2, A-4	0-5	80-100	75-90	40-80	15-45	20-25	NP-5
	4-17	Coarse sandy loam, gravelly sandy loam, sandy clay loam.	SM-SC, GM-GC	A-1, A-2, A-4	0-5	55-100	50-90	30-60	20-45	20-30	5-10
	17-60	Gravelly loamy sand, gravelly sand.	SP-SM, SM	A-1. A-2	0-5	65-100	50-80	30-60	5-30	---	NP
Vona	0-4	Loamy sand	SM	A-2	0	100	90-100	60-90	15-30	---	NP
	4-20	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	90-100	60-90	30-45	20-30	NP-10
	20-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	15-25	NP-5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
1----------	0-4	28-40	1.20-1.35	0.2-0.6	0.15-0.21	6.6-7.8	<4	Moderate--	0.37	5	5	.5-2
Apishapa	4-60	35-55	1.25-1.35	0.06-0.2	0.13-0.18	7.4-9.0	<8	High------	0.28			
2*:												
Arvada----------	0-2	20-40	1.25-1.35	0.2-2.0	0.07-0.12	>7.3	>4	Moderate--	0.32	5	4L	1-3
	2-15	40-60	1.30-1.40	<0.06	0.07-0.12	>8.4	>4	High------	0.37			
	15-60	35-50	1.20-1.30	0.2-0.6	0.07-0.12	>8.4	>4	Moderate--	0.37			
Deertrail-------	0-2	15-27	1.35-1.40	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low-------	0.37	5	5	1-2
	2-7	28-40	1.40-1.50	0.06-0.2	0.14-0.16	6.6-8.4	<4	High------	0.32			
	7-25	35-55	1.35-1.40	0.06-0.2	0.14-0.16	8.5-9.0	<4	High------	0.32			
	25-60	15-35	1.35-1.40	0.2-0.6	0.14-0.16	7.9-9.0	<4	Moderate--	0.43			
3, 4----------	0-6	5-15	1.30-1.40	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
Ascalon	6-19	18-35	1.35-1.45	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate--	0.20			
	19-35	18-30	1.35-1.45	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate--	0.20			
	35-60	3-12	1.45-1.50	2.0-6.0	0.09-0.13	7.9-9.0	<2	Low-------	0.17			
5*:												
Ascalon----------	0-6	5-15	1.30-1.40	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
	6-19	18-35	1.35-1.45	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate--	0.20			
	19-35	18-30	1.35-1.45	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate--	0.20			
	35-60	3-12	1.45-1.50	2.0-6.0	0.09-0.13	7.9-9.0	<2	Low-------	0.17			
Eckley----------	0-4	10-20	1.30-1.35	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low-------	0.24	2	3	2-4
	4-16	20-35	1.40-1.50	0.6-2.0	0.13-0.16	6.6-7.8	<2	Moderate--	0.15			
	16-60	0-5	1.55-1.65	>6.0	0.03-0.06	6.6-7.8	<2	Low-------	0.10			
6----------	0-6	15-27	1.30-1.35	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.24	5	5	1-2
Baca	6-19	35-45	1.35-1.40	0.2-0.6	0.16-0.18	6.6-8.4	<2	Moderate--	0.32			
	19-60	15-30	1.35-1.45	0.6-2.0	0.16-0.18	7.9-9.0	<2	Moderate--	0.37			
7----------	0-5	4-10	1.55-1.65	6.0-20	0.06-0.08	6.6-7.8	<2	Low-------	0.10	5	2	.5-1
Bijou	5-13	12-18	1.45-1.55	2.0-6.0	0.10-0.12	6.6-7.8	<2	Low-------	0.20			
	13-60	2-10	1.50-1.65	6.0-20	0.05-0.07	6.6-7.8	<2	Low-------	0.15			
8, 9----------	0-3	15-27	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low-------	0.43	5	4L	.5-1
Colby	3-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
10*:												
Colby----------	0-3	15-27	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low-------	0.43	5	4L	.5-1
	3-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
Satanta----------	0-8	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-------	0.28	5	6	1-2
	8-21	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate--	0.28			
	21-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low-------	0.28			
11----------	0-6	5-15	1.35-1.45	0.6-2.0	0.06-0.13	7.4-8.4	<4	Low-------	0.20	5	3	.5-1
Firstview	6-13	5-18	1.35-1.45	0.6-2.0	0.08-0.15	7.9-8.4	2-4	Low-------	0.20			
	13-27	20-35	1.30-1.40	0.6-2.0	0.08-0.16	7.9-9.0	2-8	Moderate--	0.24			
	27-58	35-50	1.25-1.35	0.06-0.2	0.06-0.12	>7.8	>16	High------	0.28			
	58-60	20-50	1.30-1.40	0.06-0.2	0.06-0.15	>7.8	>16	Moderate--	0.28			
12----------	0-10	4-30	1.20-1.50	0.6-20	0.07-0.16	7.4-8.4	<8	Low-------	0.20	5	3	<1
Fluvaquents	10-60	10-35	1.40-1.60	0.6-2.0	0.10-0.18	7.4-8.4	<8	Low-------	0.28			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
13----------	0-5	12-20	1.35-1.40	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.24	5	6	1-2
Fort Collins	5-28	18-35	1.45-1.55	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate--	0.24			
	28-60	12-27	1.45-1.55	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low-------	0.24			
14*:												
Fort Collins----	0-5	12-20	1.35-1.40	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.24	5	6	1-2
	5-28	18-35	1.45-1.55	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate--	0.24			
	28-60	12-27	1.45-1.55	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low-------	0.24			
Vona----------	0-4	3-8	1.55-1.65	6.0-20	0.06-0.08	6.6-7.8	<2	Low-------	0.15	5	2	.5-1
	4-20	8-18	1.40-1.50	2.0-6.0	0.12-0.14	6.6-8.4	<4	Low-------	0.24			
	20-60	3-15	1.45-1.55	6.0-20	0.08-0.11	7.9-9.0	<4	Low-------	0.20			
15*:												
Glenberg--------	0-10	10-20	1.45-1.50	2.0-6.0	0.09-0.13	7.4-8.4	<2	Low-------	0.15	5	3	.5-1
	10-60	8-18	1.45-1.50	2.0-6.0	0.07-0.12	7.4-9.0	<2	Low-------	0.15			
Bankard---------	0-10	2-10	1.50-1.60	6.0-20	0.10-0.15	6.6-7.8	<2	Low-------	0.17	5	2	.5-1
	10-60	0-10	1.55-1.65	6.0-20	0.07-0.15	6.6-8.4	<2	Low-------	0.17			
16----------	0-4	18-27	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low-------	0.32	5	5	1-3
Goshen	4-21	25-35	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate--	0.43			
	21-60	15-27	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
17----------	0-14	10-26	1.20-1.35	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low-------	0.28	5	4L	1-3
Haverson	14-60	18-35	1.30-1.45	0.6-2.0	0.14-0.18	7.4-9.0	2-4	Low-------	0.28			
18----------	0-5	30-40	1.25-1.35	0.2-0.6	0.12-0.17	7.4-7.8	<8	High------	0.28	5	4	.5-2
Heldt	5-60	35-50	1.25-1.45	0.06-0.2	0.12-0.17	7.9-9.0	<8	High------	0.28			
19*:												
Keith----------	0-6	15-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low-------	0.32	5	6	1-3
	6-25	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate--	0.32			
	25-60	10-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
Richfield-------	0-6	10-24	1.30-1.40	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low-------	0.32	5	6	1-3
	6-24	35-42	1.35-1.50	0.2-0.6	0.14-0.19	6.6-8.4	<2	High------	0.43			
	24-60	18-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-9.0	<2	Moderate--	0.43			
20*:												
Keith----------	0-6	15-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low-------	0.32	5	6	1-3
	6-25	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate--	0.32			
	25-60	10-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
Ulysses---------	0-8	10-27	1.15-1.25	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low-------	0.32	5	6	1-3
	8-31	21-32	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	<2	Moderate--	0.43			
	31-60	18-27	1.25-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low-------	0.43			
21, 22----------	0-7	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low-------	0.32	5	4L	.5-1
Kim	7-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low-------	0.32			
23*, 24*:												
Kim----------	0-7	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low-------	0.32	5	4L	.5-1
	7-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low-------	0.32			
Canyon----------	0-3	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.32	2	4L	.5-1
	3-13	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.43			
	13	---	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
25*:												
Kim	0-7	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.32	5	4L	.5-1
	7-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low	0.32			
Midway	0-2	30-40	1.25-1.35	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	1	4L	.5-2
	2-13	35-45	1.20-1.35	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High	0.43			
	13	---	---	---	---	---	---	---	---			
26*:												
Kim	0-7	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.32	5	4L	.5-1
	7-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low	0.32			
Pultney	0-4	15-20	1.30-1.35	0.6-2.0	0.15-0.17	7.4-8.4	<4	Low	0.28	2	3	.5-1
	4-30	18-35	1.40-1.45	0.2-0.6	0.12-0.15	7.9-8.4	4-16	Moderate	0.32			
	30	---	---	---	---	---	---	---	---			
27, 28, 29	0-4	9-17	1.35-1.40	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low	0.15	5	3	2-4
Manter	4-20	10-18	1.40-1.50	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	0.15			
	20-60	5-15	1.45-1.60	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low	0.15			
30	0-5	27-40	1.30-1.40	0.2-0.6	0.18-0.20	7.4-8.4	<4	Moderate	0.32	5	4L	1-2
Manzanola	5-26	35-45	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	26-60	30-40	1.30-1.40	0.2-0.6	0.16-0.18	7.4-9.0	<8	Moderate	0.24			
31	0-9	27-35	1.35-1.45	0.2-0.6	0.15-0.18	6.1-7.8	<2	Moderate	0.32	5	6	2-3
Nunn	9-27	35-50	1.35-1.40	0.06-0.2	0.15-0.18	6.1-8.4	<2	High	0.28			
	27-60	25-40	1.40-1.45	0.2-0.6	0.10-0.18	7.9-9.0	<2	Moderate	0.24			
32	0-4	10-20	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.20	5	3	1-2
Olney	4-14	18-35	1.40-1.45	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low	0.24			
	14-18	15-30	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.24			
	18-60	5-18	1.40-1.55	2.0-6.0	0.09-0.13	7.9-8.4	<2	Low	0.17			
33*:												
Olney	0-4	10-20	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.20	5	3	1-2
	4-14	18-35	1.40-1.45	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low	0.24			
	14-18	15-30	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.24			
	18-60	5-18	1.40-1.55	2.0-6.0	0.09-0.13	7.9-8.4	<2	Low	0.17			
Manzanola	0-5	27-40	1.30-1.40	0.2-0.6	0.18-0.20	7.4-8.4	<4	Moderate	0.32	5	4L	1-2
	5-21	35-45	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	21-60	30-40	1.30-1.40	0.2-0.6	0.16-0.18	7.4-9.0	<8	Moderate	0.24			
34*:												
Otero	0-5	10-20	1.40-1.45	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low	0.20	5	3	.5-2
	5-60	5-18	1.45-1.50	2.0-6.0	0.08-0.12	7.4-8.4	<4	Low	0.17			
Olney	0-4	10-20	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.20	5	3	1-2
	4-14	18-35	1.40-1.45	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low	0.24			
	14-18	15-30	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.24			
	18-60	5-18	1.40-1.55	2.0-6.0	0.09-0.13	7.9-8.4	<2	Low	0.17			
35	0-2	28-40	1.35-1.40	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.32	2	4L	.5-2
Razor	2-11	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	11-30	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	>8	High	0.28			
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See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
36*:												
Razor	0-2	28-40	1.35-1.40	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.32	2	4L	.5-2
	2-13	35-50	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	13-30	35-50	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	>8	High	0.28			
	30	---	---	---	---	---	---	---	---			
Midway	0-2	30-40	1.25-1.35	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	1	4L	.5-2
	2-13	35-45	1.20-1.35	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High	0.43			
	13	---	---	---	---	---	---	---	---			
37	0-5	15-27	1.25-1.35	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	5	5	1-4
Sampson	5-30	18-35	1.30-1.40	0.6-2.0	0.17-0.19	6.6-7.8	<2	Moderate	0.24			
	30-78	15-30	1.35-1.45	0.6-2.0	0.13-0.17	7.9-8.4	<2	Low	0.28			
38	0-8	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low	0.28	5	6	1-2
Satanta	8-21	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	21-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low	0.28			
39*:												
Satanta	0-8	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low	0.28	5	6	1-2
	8-21	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	21-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low	0.28			
Colby	0-3	15-27	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low	0.43	5	4L	.5-1
	3-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
40*:												
Schamber	0-10	18-25	1.40-1.60	>6.0	0.03-0.06	6.1-8.4	<2	Low	0.17	2	6	.5-2
	10-60	2-10	1.40-1.65	>6.0	0.03-0.06	7.4-8.4	<2	Low	0.10			
Stoneham	0-3	15-27	1.35-1.40	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	5	4L	.5-2
	3-7	20-35	1.40-1.45	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.24			
	7-60	20-35	1.40-1.45	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24			
41, 42	0-3	15-27	1.35-1.40	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	5	4L	.5-2
Stoneham	3-7	20-35	1.40-1.45	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.24			
	7-60	20-35	1.40-1.45	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24			
43*:												
Stoneham	0-3	15-27	1.35-1.40	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	5	4L	.5-2
	3-7	20-35	1.40-1.45	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.24			
	7-60	20-35	1.40-1.45	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24			
Kim	0-7	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.32	5	4L	.5-1
	7-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low	0.32			
44*:												
Stoneham	0-3	15-27	1.35-1.40	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	5	4L	.5-2
	3-7	20-35	1.40-1.45	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.24			
	7-60	20-35	1.40-1.45	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24			
Razor	0-2	28-40	1.35-1.40	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.32	2	4L	.5-2
	2-11	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	11-30	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	>8	High	0.28			
	30	---	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
45	0-8	5-10	1.50-1.60	>6.0	0.06-0.08	6.6-7.3	<2	Low	0.15	5	2	.5-1
Sundance	8-16	15-25	1.45-1.55	0.6-2.0	0.10-0.13	6.6-7.3	<2	Low	0.20			
	16-50	27-35	1.40-1.50	0.2-0.6	0.16-0.18	7.4-8.4	<2	Moderate	0.32			
	50-60	10-25	1.30-1.40	0.6-2.0	0.16-0.18	7.9-8.4	<2	Low	0.43			
46	0-10	3-12	1.50-1.60	2.0-6.0	0.06-0.13	6.6-7.8	<2	Low	0.10	5	2	.5-1
Ulm	10-25	35-50	1.30-1.35	0.06-0.2	0.14-0.19	7.4-8.4	<2	High	0.37			
	25-46	35-45	1.30-1.40	0.2-0.6	0.13-0.18	7.9-8.4	<2	Moderate	0.28			
	46-60	25-35	1.30-1.45	0.6-2.0	0.13-0.18	7.9-8.4	<4	Low	0.28			
47	0-3	20-25	1.15-1.25	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.32	5	6	1-3
Ulm	3-19	35-50	1.20-1.30	0.06-2.0	0.19-0.21	6.6-8.4	<2	High	0.37			
	19-30	30-42	1.20-1.30	0.2-2.0	0.19-0.21	7.9-9.0	<2	Moderate	0.37			
	30-60	25-35	1.25-1.35	0.6-2.0	0.12-0.15	7.9-9.0	<2	Moderate	0.37			
48	0-16	3-10	1.50-1.60	6.0-20	0.07-0.12	6.6-7.8	<2	Low	0.10	5	1	.5-1
Valent	16-60	2-8	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.10			
49*:												
Valent	0-16	3-10	1.50-1.60	6.0-20	0.07-0.12	6.6-7.8	<2	Low	0.10	5	1	.5-1
	16-60	2-8	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.10			
Vona	0-4	3-8	1.55-1.65	6.0-20	0.06-0.08	6.6-7.8	<2	Low	0.15	5	2	.5-1
	4-20	8-18	1.40-1.50	2.0-6.0	0.12-0.14	6.6-8.4	<4	Low	0.24			
	20-60	3-15	1.45-1.55	6.0-20	0.08-0.11	7.9-9.0	<4	Low	0.20			
Bijou	0-5	4-10	1.55-1.65	6.0-20	0.06-0.08	6.6-7.8	<2	Low	0.10	5	2	.5-1
	5-13	12-18	1.45-1.55	2.0-6.0	0.10-0.12	6.6-7.8	<2	Low	0.20			
	13-60	2-10	1.50-1.65	6.0-20	0.05-0.07	6.6-7.8	<2	Low	0.15			
50, 51	0-4	3-8	1.55-1.65	6.0-20	0.06-0.08	6.6-7.8	<2	Low	0.15	5	2	.5-1
Vona	4-20	8-18	1.40-1.50	2.0-6.0	0.12-0.14	6.6-8.4	<4	Low	0.24			
	20-60	3-15	1.45-1.55	6.0-20	0.08-0.11	7.9-9.0	<4	Low	0.20			
52*:												
Vona	0-4	3-8	1.55-1.65	6.0-20	0.06-0.08	6.6-7.8	<2	Low	0.15	5	2	.5-1
	4-20	8-18	1.40-1.50	2.0-6.0	0.12-0.14	6.6-8.4	<4	Low	0.24			
	20-60	3-15	1.45-1.55	6.0-20	0.08-0.11	7.9-9.0	<4	Low	0.20			
Olney	0-4	10-20	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.20	5	3	1-2
	4-14	18-35	1.40-1.45	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low	0.24			
	14-18	15-30	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.24			
	18-60	5-18	1.40-1.55	2.0-6.0	0.09-0.13	7.9-8.4	<2	Low	0.17			
53	0-3	15-27	1.25-1.35	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low	0.32	5	6	2-4
Weld	3-21	35-50	1.30-1.40	0.06-0.2	0.18-0.20	6.6-8.4	<2	High	0.28			
	21-60	20-35	1.25-1.35	0.6-2.0	0.12-0.18	7.4-9.0	<2	Moderate	0.28			
54, 55	0-3	15-27	1.25-1.35	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low	0.37	5	4L	.5-1
Wiley	3-23	18-35	1.30-1.40	0.6-2.0	0.19-0.21	7.9-8.4	<2	Moderate	0.32			
	23-60	18-27	1.30-1.40	0.6-2.0	0.14-0.21	7.9-9.0	<2	Low	0.37			
56*:												
Yoder	0-4	10-20	1.45-1.55	2.0-6.0	0.10-0.13	6.1-7.8	<2	Low	0.10	2	3	.5-1
	4-17	18-35	1.35-1.50	2.0-6.0	0.10-0.16	6.1-7.8	<2	Low	0.15			
	17-60	0-5	1.50-1.60	6.0-20	0.04-0.08	6.1-7.8	<2	Low	0.10			
Stoneham	0-3	15-27	1.35-1.40	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	5	4L	.5-2
	3-7	20-35	1.40-1.45	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.24			
	7-60	20-35	1.40-1.45	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
57*:												
Yoder	0-4	10-20	1.45-1.55	2.0-6.0	0.10-0.13	6.1-7.8	<2	Low	0.10	2	3	.5-1
	4-17	18-35	1.35-1.50	2.0-6.0	0.10-0.16	6.1-7.8	<2	Low	0.15			
	17-60	0-5	1.50-1.60	6.0-20	0.04-0.08	6.1-7.8	<2	Low	0.10			
Vona	0-4	3-8	1.55-1.65	6.0-20	0.06-0.08	6.6-7.8	<2	Low	0.15	5	2	.5-1
	4-20	8-18	1.40-1.50	2.0-6.0	0.12-0.14	6.6-8.4	<4	Low	0.24			
	20-60	3-15	1.45-1.55	6.0-20	0.08-0.11	7.9-9.0	<4	Low	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1---------- Apishapa	D	None----------	----------	-------	+3-1.0	Apparent	Apr-Sep	>60	---	High-----	High-----	High.
2*:												
Arvada----------	D	Rare----------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Deertrail--------	C	Rare----------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
3, 4---------- Ascalon	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
5*:												
Ascalon----------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Eckley----------	B	None----------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
6---------- Baca	B	None----------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
7---------- Bijou	B	None----------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
8, 9---------- Colby	B	None----------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
10*:												
Colby----------	B	None----------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Satanta----------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
11---------- Firstview	C	None----------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
12---------- Fluvaquents	D	Frequent-----	Brief-----	Mar-Sep	0.5-2.0	Apparent	Mar-Sep	>60	---	High-----	High-----	Low.
13---------- Fort Collins	B	None----------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
14*:												
Fort Collins-----	B	None----------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Vona----------	B	None----------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
15*:												
Glenberg	B	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
Bankard	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low	Moderate	Low.
16--- Goshen	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
17--- Haverson	B	Occasional	Brief	May-Sep	>6.0	---	---	>60	---	Low	High	Low.
18--- Heldt	C	Rare	---	---	>6.0	---	---	>60	---	High	High	Moderate.
19*:												
Keith	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Richfield	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
20*:												
Keith	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ulysses	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
21, 22--- Kim	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
23*, 24*:												
Kim	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
25*:												
Kim	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Midway	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
26*:												
Kim	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Pultney	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
27, 28, 29--- Manter	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
30--- Manzanola	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
31---------- Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
32---------- Olney	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
33*:												
Olney----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Manzanola----------	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
34*:												
Otero----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Olney----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
35---------- Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
36*:												
Razor----------	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
Midway----------	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
37---------- Sampson	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
38---------- Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
39*:												
Satanta----------	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Colby----------	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
40*:												
Schamber----------	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Stoneham----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
41, 42---------- Stoneham	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
43*:												
Stoneham----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Kim----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
44*:												
Stoneham	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
45--Sundance	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
46--Ulm	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
47--Ulm	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
48--Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
49*:												
Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Vona	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Bijou	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
50, 51--Vona	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
52*:												
Vona	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Olney	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
53--Weld	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
54, 55--Wiley	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
56*:												
Yoder	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Stoneham	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
57*:												
Yoder	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Vona	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Apishapa Family	Fine, montmorillonitic (calcareous), mesic Vertic Fluvaquents
Arvada	Fine, montmorillonitic, mesic Ustollic Natrargids
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Baca	Fine, montmorillonitic, mesic Ustollic Haplargids
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Bijou	Coarse-loamy, mixed, mesic Ustollic Haplargids
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Deertrail	Fine, montmorillonitic, mesic Haplustollic Natrargids
Eckley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Firstview	Fine-loamy, mixed, mesic Ustollic Natrargids
Fluvaquents	Fluvaquents
Fort Collins	Fine-loamy, mixed, mesic Ustollic Haplargids
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Goshen	Fine-silty, mixed, mesic Pachic Argiustolls
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Heldt	Fine, montmorillonitic, mesic Ustertic Camborthids
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Kim	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents
Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Manzanola	Fine, montmorillonitic, mesic Ustollic Haplargids
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Olney	Fine-loamy, mixed, mesic Ustollic Haplargids
Otero	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
Pultney	Fine-loamy, mixed, mesic Ustollic Calciorthids
Razor	Fine, montmorillonitic, mesic Ustollic Camborthids
Richfield	Fine, montmorillonitic, mesic Aridic Argiustolls
Sampson	Fine-loamy, mixed, mesic Pachic Argiustolls
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Schamber	Sandy-skeletal, mixed, mesic Ustic Torriorthents
Stoneham	Fine-loamy, mixed, mesic Ustollic Haplargids
Sundance	Fine-loamy, mixed, mesic Ustollic Haplargids
Ulm	Fine, montmorillonitic, mesic Ustollic Haplargids
Ulysses	Fine-silty, mixed, mesic Aridic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments
Vona	Coarse-loamy, mixed, mesic Ustollic Haplargids
Weld	Fine, montmorillonitic, mesic Aridic Paleustolls
Wiley	Fine-silty, mixed, mesic Ustollic Haplargids
Yoder	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Ustollic Haplargids

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